



JOURNAL
OF THE
NEW YORK
ENTOMOLOGICAL SOCIETY

Devoted to Entomology in General

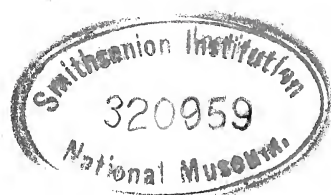
VOLUME XL, 1932

PUBLISHED QUARTERLY BY THE SOCIETY

LIME AND GREEN STS.

NEW YORK, N. Y.

LANCASTER, PA.



CONTENTS OF VOLUME XL

	PAGE
BARBER, H. G.	
Three New Species of Exptochiomera from the United States (Hemiptera-Lygæidæ)	357
BECK, D. ELDEN	
Life History Notes and a Study of the Effects of Humidity on Adult Emergence of Rhagoletis suavis Cress., from Pupæ at a Constant Temperature (Diptera, Trypetidæ)	497
BISHOP, SHERMAN C., and C. R. CROSBY	
Studies in American Spiders: the Genus Grammonta	393
BOOK NOTICES	99, 389, 502, 563
BROWER, A. E.	
Eurymus eurytheme in Maine	510
COCKERELL, T. D. A.	
Bees Collected by Charles Darwin on the Voyage of the "Beagle"	519
CROSBY, C. R.	
See BISHOP, SHERMAN C.	
DAVIS, W. T.	
Additional Records of North American Cicadas with Descriptions of New Species	241
DAWSON, R. W.	
New Species of Serica (Scarabæidæ), VI	529
DECKER, GEORGE C.	
Biology of the Bidens Borer, Epiblema otiosana (Clemens) (Lepidoptera, Olethreutidæ)	503
DRIGGERS, BYRLEY F.	
Cocoon Parasites of the Oriental Fruit Moth	489
ERRATA	391
FALL, H. C.	
New North American Scarabæidæ, with Remarks on Known Species	183

	PAGE
FORBES, WM. T. M.	
The Rubidella Group Aristotelia (Lepidoptera, Gelechiidæ)	423
GODING, FREDERIC W.	
The Membracidæ of Africa	205
HATCH, MELVILLE H.	
"Neecrophorus" or "Nicrophorus"	391
HUCKETT, H. C.	
The North-American Species of the Genus <i>Limnophora</i> Robineau-Desvoidy, With Descriptions of New Species (Muscidæ, Diptera)	25, 105, 279
JAMES, MAURICE T.	
New and Little-Known Colorado Diptera	435
KLOTS, ALEXANDER B.	
New Records of Lepidoptera from New York	385
LEARNED, E. T.	
An Occurrence of Spiral Segmentation in <i>Apantesis nais</i> (Lep., Aret.)	167
LENG, CHARLES W., and W. T. DAVIS	
Review of "In Days Agone"	502
NICOLAY, A. S., and HARRY B. WEISS	
Synopsis of the Cicindelidæ, I	341
NOTICE	528
PARK, ORLANDO	
The Food of <i>Batrisodes globosus</i> (Lec.), (Coleop., Pselaphidæ)	377
PETERSON, ALVAH	
Are Economic Entomologists Becoming "Insecticide Minded"?	159
PETRUNKOVITCH, ALEXANDER	
Collecting <i>Hypochilus</i>	19
Proceedings of the New York Entomological Society	267
RUDOLFS, WILLEM	
Studies on Chemical Changes During the Life Cycle of the Tent Caterpillar (<i>Malacosoma americana</i> Fab.) V. Weight and Data	481

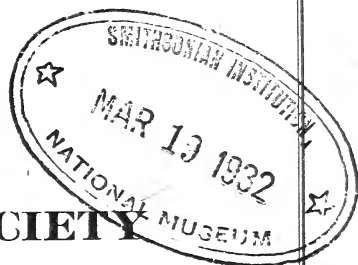
SCHAUS, W.	
A New Form of <i>Hyloicus</i> Discovered in Ecuador by W. Judson Coxey	375
SIM, ROBERT J.	
Five Sericine Beetles	379
STOLLMEYER, C. REX	
Notes on the Life History of <i>Morpho peleides insularis</i> Fruhstorfer	523
TOWNSEND, CHARLES H. T.	
New Genera and Species of Old World Oestromuscoid Flies	439
TRAVER, JAY R.	
Neocloeon, a New Mayfly Genus (Ephemeriðæ)	365
WADE, J. S.	
Book Notice	102, 389
WATSON, FRANK E.	
Book Notice	100
Miscellaneous Notes	98
WEISS, HARRY B.	
Book Notice	99, 563
The Entomology of the "Orbis Pictus" of John Amos Comenius Together with Notes on Several Early American Entomological Juveniles	511
John Pointer's Collection of Insects	95
See Nicolay, A. S.	
WHEELER, WILLIAM MORTON	
A List of the Ants of Florida with Descriptions of New Forms	1
WILSON, J. W.	
Coleoptera and Diptera Collected from a New Jersey Sheep Pasture	77

Vol. XL

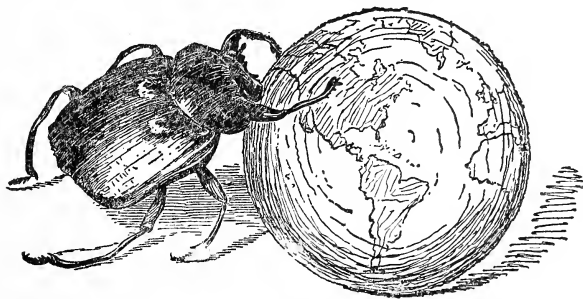
MARCH, 1932

No. 1

JOURNAL
OF THE
NEW YORK
ENTOMOLOGICAL SOCIETY



Devoted to Entomology in General



MARCH, 1932

Edited by HARRY B. WEISS

Publication Committee

HARRY B. WEISS

CHARLES W. LENG
C. E. OLSEN

J. D. SHERMAN, JR.

Published Quarterly by the Society

LIME AND GREEN STS.
LANCASTER, PA.
NEW YORK, N. Y.

1932

Entered as second class matter July 7, 1925, at the post office at Lancaster, Pa., under the Act of August 24, 1912.
Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized March 27, 1924.

Subscription \$3.00 per Year.

CONTENTS

A List of the Ants of Florida with Descriptions of New Forms.	
BY WILLIAM MORTON WHEELER	1
Collecting Hypochilus.	
BY ALEXANDER PETRUNKEVITCH	19
The North American Species of the Genus <i>Limnophora</i> Robineau-Desvoidy, with Descriptions of New Species (Muscidæ, Diptera).	
BY H. C. HUCKETT	25
Coleoptera and Diptera Collected from a New Jersey Sheep Pasture.	
BY J. W. WILSON	77
John Pointer's Collection of Insects.	
BY HARRY B. WEISS	95
Miscellaneous Note	98
Book Notices.....	99
 NOTICE: VOLUME XXXIX, NUMBER 4, OF THE JOURNAL OF THE NEW YORK ENTOMOLOGICAL SOCIETY WAS PUBLISHED ON JANUARY 5, 1932.	

JOURNAL

OF THE

New York Entomological Society

VOL. XL

MARCH, 1932

No. 1

A LIST OF THE ANTS OF FLORIDA WITH DESCRIPTIONS OF NEW FORMS

BY WILLIAM MORTON WHEELER

Dr. M. R. Smith has very recently published such a conscientious list of the ants of Florida (Florida Entomologist 14, 1930, pp. 1-16) that there would seem to be little immediate need to cover the same ground again. A visit, however, to the southern counties of the state during the winter of 1930 to 1931 and the finding of considerable additional material both in the Museum of Comparative Zoology and in my own collection have induced me to undertake the task. Dr. Smith's list comprises 75 forms, if we include *Eciton schmitti* Emery, which has not yet been taken in Florida, and omit *Crematogaster punctulata* Emery, which seems to be a misidentification. In the present list 16 additional forms, several of them new to science, or to the fauna of the United States are included, together with a number of new locality records for many of the species previously enumerated.

Of course, the list herewith presented is still incomplete. It will probably be considerably increased when some of our naturalists, who pass their winters in Florida, go in for intensive observation and collection of the ants. The fact that the Formicidæ, unlike most groups of insects, are active even during December and January, at least in southern Florida, should make them attractive objects of study, especially as few states in the Union possess so many interesting species. These comprise members of several singular tropical genera—Euponera,

MAR 17 1932

Leptogenys, Odontomachus, Pseudomyrma, Cardiocondyla, Xenomyrmex, Antillamyrmex, Wasmannia, Cryptocerus, Cyphomyrmex and Iridomyrmex—which are either absent or rather rare in our other Southern States, a unique harvesting ant, *Pogonomyrmex badius*, with polymorphic workers, and a Crematogaster, *C. atkinsoni*, which is also unique among its North American congeners in building large carton nests on plants. The Florida ant-fauna is peculiar, moreover, because fully a third of its species, subspecies and varieties regularly nest in plant-cavities—twigs, weed-stems, branches, sedge-culms, interstices between the over-lapping leaves of certain “air-plants” (Tillandsias), probably an adaptation to edaphic conditions since the soil, at least in the southern part of the peninsula, is either absent or very shallow and poorly drained. Both entomologists and botanists will therefore find the search for the concealed nests in the vegetation of the hammocks, everglades and cypress swamps a fascinating occupation and will be astonished at the variety and abundance of ants in a region which the casual observer may be inclined to regard as possessing a very meager and uninteresting fauna.

For generous aid in visiting many localities in southern Florida and securing most of the new data recorded in the following pages I am indebted to my friends Dr. David Fairchild, his son, Mr. Graham Fairchild, and Mr. Fred Burgess, grandson of an illustrious American entomologist and yacht-designer.

Family Formicidae
Subfamily Dorylinae

- (1) *Eciton (Acamatus) opacithorax* Emery—St. Augustine, (C. T. Brues).
- (2) *Eciton (Acamatus) schmitti* Emery.

According to Dr. M. R. Smith, “this species undoubtedly occurs in the state as it is common in the adjoining states.” For some reason the genus *Eciton* is more poorly represented in Florida than in the other Gulf states or even in the Carolinas.

Subfamily Ponerinae

- (3) *Stigmatomma pallipes* Haldeman — Dunedin (W. S. Blatchley).

A rather rare ant, distributed throughout the United States and represented by several varieties or subspecies, some of which are still undescribed.

- (4) *Euponera* (*Trachymesopus*) *stigma* Fabr.—Lake Worth (J. Schmitt).

A common neotropical form, but known only from this single locality in the United States.

- (5) *Ponera coarctata* Latreille subsp. *pennsylvanica* Buckley—Monticello; Gainesville; cited from "Florida" by Emery.

Common and widely distributed in the states east of the Mississippi.

- (6) *Ponera opaciceps* Mayr—Royal Palm Park and Dunedin (W. S. Blatchley).

- (7) *Ponera trigona* Mayr var. *opacior* Forel—Jacksonville (Wheeler).

Like the preceding a widely distributed neotropical form.

- (8) *Leptogenys* (*Lobopelta*) *elongata* Buckley subsp. *manni* Wheeler—Bellair.

Apparently a local race of the typical *elongata*, which ranges from Georgia to Texas.

- (9) *Odontomachus hamatoda* L. subsp. *insularis* Guérin—Lake Worth (J. Schmitt); Enterprise (W. Beutenmueller); Biscayne Bay (Mrs. A. T. Slosson); Coconut Grove, Lower Matacombe Key and Paradise Key (Wheeler); Tallahassee; Gainesville; Monticello; Lakeland. Deep Lake; Miami (A. E. Wight); St. Petersburg (H. Roster); Royal Palm Park (W. S. Blatchley).

Very generally distributed throughout the state and living in small colonies under stones, logs, boards, etc. It seems to be an immigrant from the West Indies, where it is common.

Subfamily Pseudomyrminae

- (10) *Pseudomyrma Brunnea* F. Smith—Haw Creek, Volusia Co. (T. Pergande); Tallahassee; Royal Palm Park and Dunedin (W. S. Blatchley); Lakeland; Miami (H. Hebard); Paradise Key, Long Pine Key, Lower Matacombe Key and Pine Crest (Wheeler).

Nesting in dead twigs and the culms of grasses and sedges. Blatchley describes it as nesting "in the roots of bunches of grass along the ditches," but this is certainly an error.

- (11) *Pseudomyrma elongata* Mayr—Key West (T. Pergande); Royal Palm Park and Dunedin (W. S. Blatchley); Miami (M. Hebard; W. E. Wight); Coconut Grove, Paradise Key, Long Pine Key and Lower Matacombie Key (Wheeler); Biscayne Bay (Mrs. A. T. Slosson).

Nesting in twigs of trees, including those of the sea-grape (*Coccoloba uvifera*), and in the culms of grasses and sedges. Common also in Cuba where it is represented by several varieties.

- (12) *Pseudomyrma flavidula* F. Smith—Key West (T. Pergande); Key Largo, Biscayne Bay; Card's Point, Paradise Key, Long Pine Key, Lower Matacombie Key, Pine Crest (Wheeler); Miami (P. Laurent); Royal Palm Park and Dunedin (W. S. Blatchley).

Common throughout the southern portion of the state in weed stems and the culms of grasses and sedges, less frequently in the twigs of trees and shrubs.

- (13) *Pseudomyrma pallida* F. Smith—"Florida" (Norton; S. Henshaw); Clearwater; Kissimee; Dunedin (W. S. Blatchley).

Less abundant than the preceding species but nesting in the same manner.

Subfamily Myrmicina

- (14) *Pogonomyrmex badius* Latreille—St. Petersburg (H. Raster); Rock Springs (H. T. Woodruff); Fort Worth and Sanford (P. Schmitt); Grant; Inverness (C. M. Weed); Jacksonville (Wheeler; Van Duzee); Lakeland; St. Augustine (C. T. Brues); Carrabelle; Gulfport (Reynolds); Kissimee; Pensacola; De Funiak Springs; Gainesville; Marco.

I have not seen specimens of this large agricultural ant from the southern portion of the state, where, perhaps, the soil conditions are most unfavorable to its nesting habits.

- (15) *Aphaenogaster (Attomyrma) fulva* Roger subsp. *aquia* Buckley.

Recorded by Dr. R. M. Smith from Royal Palm Park. I have seen a specimen of this northern ant from Dunedin (W. S. Blatchley).

(16) *Aphaenogaster (Attomyrma) lamellidens* Mayr.

Recorded by Mayr and Emery from "Florida," without precise locality. The species belongs to the Carolinian fauna and probably enters the northern counties of the state.

(17) *Aphaenogaster (Attomyrma) mariæ* Forel.

Originally described from specimens taken in Florida by Mrs. Mary Treat. There are specimens in my collection labeled "Florida" and taken by T. Pergande. I have inferred from the small size of the female of this ant that it is, like *A. tennesseensis* Mayr, a temporary social parasite of some species of *Aphaenogaster*, probably *fulva*.

(18) *Aphaenogaster (Attomyrma) texana* Emery var. *furvescens* Wheeler. Royal Palm Park (W. S. Blatchley).
Nesting under stones and logs.

(19) *Aphaenogaster (Attomyrma) texana* var. *silvestrii* Menozzi.
Gainesville (F. Silvestri).

This form, originally described by Menozzi as an independent species and erroneously referred to the subgenus *Deromyrma*, is scarcely distinct from the preceding variety. I possess a number of workers and a deälated female from the type locality, which agree very closely with Menozzi's description.

(20) *Aphaenogaster (Attomyrma) texana* var. *miamiana* var. nov.

WORKER. Length 5-5.7 mm.

More robust and averaging larger than the other forms of *texana*: head broader and less narrowed behind, though without posterior corners, the postocular outline from above semicircular; antennal scapes stouter and slightly shorter; epinotal spines longer, slender and acute. Sculpture decidedly coarser throughout, mandibles, clypeus and head more strongly longitudinally rugose; pronotum and base of epinotum transversely, sides of thorax longitudinally rugulose. Pubescence on legs somewhat more distinct and more abundant. Rich ferruginous red, antennæ paler, posterior portion of gaster dark brown; coxæ and legs yellow-brown.

FEMALE. (deälated). Length about 7 mm.

Smaller than the female of the typical *texana* which measures 8-8.5 mm. and exhibiting the same differences in sculpture, pilosity and color as the worker.

MALE. Length 4.5 mm.

Very similar to the male of the typical *texana* but the head slightly broader and the epinotal protuberances of a different shape, being less swollen and not separated by a longitudinal dorsal impression. Mesonotum less shining and more sharply rugulose posteriorly.

Described from eight workers, three females and a male taken by A. E. Wight at Miami, Florida (type-locality), two females from the same locality taken by M. Hebard, several workers collected by myself on Paradise Key and at Planter on Key Largo and three workers from Biscayne Bay (Mrs. A. T. Slosson).

(21) *Aphaenogaster (Attomyrma) texana* subsp. *nana* subsp. nov.

WORKER. Length 2.5 mm.

Much smaller than any of the other forms of *texana* and more feebly sculptured, the head thorax and ventral portions of the pedicel finely and densely punctate, with only a few longitudinal rugules on the cheeks and sides of the front where they continue the frontal carinæ; occiput, anterior portion of the pronotum and summits of the petiolar and postpetiolar nodes smooth and shining. Ferruginous brown; coxæ, legs and mandibles, except their teeth, yellow.

Three workers Gainesville, Florida.

(22) *Aphaenogaster (Attomyrma) treatæ* Forel var. *ashmeadi* Emery.

This form was cited by Mayr and Emery from Florida. I possess a few workers from Tallahassee (L. S. Barber).

(23) *Pheidole anastasii* Emery—Sanford and Lake Worth (J. Schmitt); Dunedin (W. S. Blatchley).

Originally described from Costa Rica. It occurs also in Mexico.

(24) *Pheidole commutata* Mayr—Miami (A. E. Wight); Everglade; Pigeon Key (Wheeler); Gainesville; St. Augustine (C. T. Brues); De Funiak Springs; Biscayne Bay (Mrs. A. T. Slosson); Long Pine Key (Wheeler).

Originally described from specimens taken by Ashmead and Pergande in Florida.

(25) *Pheidole dentata* Mayr—Miami (Wheeler); Royal Palm Park (W. S. Blatchley).

(26) *Pheidole floridana* Emery—Coconut Grove (type locality) and St. George (T. Pergande); Royal Palm Park and Dunedin (W. S. Blatchley); Coconut Grove (G. Fairchild).

- (27) *Pheidole metallescens* Emery—St. George, type locality (T. Pergande); Jacksonville (Wheeler); Royal Palm Park (W. S. Blatchley).
- (28) *Pheidole morrisi* Forel—Royal Palm Park (W. S. Blatchley); St. Petersburg (H. Raster); Inverness (C. M. Weed).
- (29) *Cardiocondyla emeryi* Forel—Miami (Amer. Mus. Nat. Hist.).
- (30) *Cardiocondyla nuda* Mayr var. *minutior* Forel—Miami (W. E. Wight), numerous specimens.

This tiny ant has not been recorded heretofore from the United States.

- (31) *Cardiocondyla wroughtoni* Forel var. *bimaculata* Wheeler.

Two colonies containing a number of females, taken in hollow culms of sedges at Royal Palm Park (Wheeler). This variety was originally described from Formosa and closely resembles the var. *hawaiiensis* Forel, except that the two spots on the sides of the first gastric segment of the worker are large and dark brown. Sometimes there is a third smaller and paler brown spot in the middorsal like. The typical *wroughtoni* was originally described from India. This ant, like the preceding, is new to the fauna of the United States and has probably been very recently introduced from the Orient in living plants.

- (32) *Xenomyrmex stolli* Forel subsp. *floridanus* Emery—Lake Worth (T. Pergande), nesting in a twig of a gumbo-limbo tree (*Sideroxylon masticodendron*); Dunedin, workers and females (W. S. Blatchley).
- (33) *Xenomyrmex stolli* subsp. *rufescens* Wheeler.

Recently described from a single dealated female taken on Long Pine Key (Wheeler).

- (34) *Crematogaster (Acrocoelia) ashmeadi* Mayr—Key West (T. Pergande); Miami (Wheeler, A. E. Wight, P. Laurent); Card's Point, Key Largo, Long Pine Key, Lower Matacombie Key, Pine Crest and Bottle Point Key, on red mangrove (Wheeler); Biscayne Bay (Mrs. A. T. Slosson), on mangrove trunks; St. Augustine (C. T. Brues), in flower-stalks of *Yucca*; Dunedin (W. S. Blatchley).

The worker of this species, as Mayr observed, is very variable in color. My specimens from northern Florida and the other Gulf States as far west as central Texas are red or even yellowish, with the tip or posterior half of the gaster more or less infuscated. Some specimens are entirely yellowish red. The male of this form also has a yellow gaster. In southern Florida the workers are decidedly darker, the head, thorax, pedicel, base of gaster and the appendages being usually dark reddish brown or castaneous with most of the gaster black. This form is obviously transitional to the following variety:

(35) *Crematogaster (Acrocoelia) ashmeadi* var. *matura* var. nov.

WORKER. Length 2.8–3.5 mm.

Differing from the typical form of the species in having distinctly longer and more tapering epinotal spines and a broader postpetiole, with more strongly separated dorsal tubercles. The thorax is somewhat more shining and more distinctly punctate-striate, the color is much darker, being black, with the antennæ and petiole very dark brown, the mandibles, tarsi, trochanters, bases and tips of femora paler and more reddish.

This variety is based on specimens which I collected near Miami. Others which I took on Cocoplum Beach near Coconut Grove and on Paradise Key have the thorax castaneous brown. In those from the former locality the peculiarity of the petiole is very pronounced.

(36) *Crematogaster (Acrocoelia) atkinsoni* Wheeler—Ft. Myers (type locality); Royal Palm Park (W. S. Blatchley); Long Pine Key and Big Cypress Swamp, near Pine Crest (Wheeler); Tallahassee.

All three castes of this species are very similar to those of the typical form of our northern *C. lineolata*, but as was pointed out in my original description, its habits are very different since it makes nests of very coarse gray or blackish carton on sedges or bushes half a meter or more above the ground so that the colonies are well out of reach of high water in the everglades and cypress swamps. Nests were found both on Long Pine Key and near Pine Crest, but were most numerous in the latter locality. The largest seen was taken by Messrs. Graham Fairchild and Fred Burgess in the former region. It was somewhat triangular in shape and flattened, measuring $30 \times 15 \times 9$ cm. The numerous nests which I examined along the road through the Big Cypress

Swamp were smaller and more regularly spherical or ellipsoidal, varying from the size of an egg or orange to nearly the size of one's head. I found that the recently fecundated queen of *atkinsoni* first establishes herself in the cavity of a sedge culm and there rears her first broods of workers till they become too numerous to be accommodated in the cavity. They then enclose the sedge for some distance in an irregular carton sheath and continue for some time to inhabit both the cavity of the culm and the spaces between its outer surface and the carton. Finally, with still greater increase in the population, additional layers of carton, containing the galleries and chambers, are applied to the outside of the nest till it attains its full dimensions. The colony is then very populous, produces many males and winged females and defends itself vigorously when its paper domicile is roughly handled. Dr. M. R. Smith quotes some observations of Blatchley on the nests of this ant at Royal Palm Park.

- (37) *Crematogaster (Acrocoelia) atkinsoni* var. *helveola* Wheeler—Lake Worth (J. Schmitt).
- (38) *Crematogaster (Acrocoelia) lineolata* Say—Pensacola.
- (39) *Crematogaster (Acrocoelia) lineolata* Say subsp. *laeviuscula* Mayr—Recorded by Mayr and Emery from "Florida." Royal Palm Park and Dunedin (W. S. Blatchley).
- (40) *Crematogaster (Acrocoelia) lineolata* subsp. *pilosa* Pergande—Dunedin (W. S. Blatchley).
- (41) *Crematogaster (Orthocrema) minutissima* Mayr—Royal Palm Park and Dunedin (W. S. Blatchley); Lakeland; Tallahassee.
- (42) *Monomorium floricola* Jerdon—Biscayne Bay (Mrs. A. T. Slosson); Key Largo, Miami Beach, Lower Matacombie Key, Paradise Key, Long Pine Key, Pine Crest, Hollywood (Wheeler); Royal Palm Park (W. S. Blatchley); Miami (A. E. Wight).

Blatchley states that this ant "nests beneath stones in damp localities" but as I have always taken it in plant-cavities (hollow twigs or Tillandsias) I suspect that his specimens belonged to *M. minimum* Buckley.

- (43) *Monomorium minimum* Buckley—Miami (A. E. Wight); Titusville, Royal Palm Park (W. S. Blatchley);

Biscayne Bay (Mrs. A. T. Slosson); Miami, Coconut Grove, Paradise Key, Long Pine Key, Lower Matacombie Key, Hollywood, etc. (Wheeler).

A common ant in the Carolinian and Austroriparian Zones, nesting under stones and in small crater nests in the soil.

- (44) *Monomorium pharaonis* L.—Gainesville (A. H. Byer); Deep Lake; Miami (H. T. Woodruff); Key Largo, Paradise Key, Homestead (Wheeler); Royal Palm Park (W. S. Blatchley).

The commonest of house-ants in the northern States but nesting also out-of-doors in Southern Florida.

- (45) *Solenopsis geminata* Fabr.—Miami, Jacksonville (Wheeler); St. Augustine (C. T. Brues); Fort Myers (Amer. Mus. Nat. Hist.); Dunedin (W. S. Blatchley).

This typical form of a highly variable species seems to be less abundant in Florida than the following red subspecies.

- (46) *Solenopsis geminata* Fabr. subsp. *rufa* Jerdon—Miami (Wheeler, A. E. Wight); Gainesville; Ft. Myers (Amer. Mus. Nat. Hist.); Lakeport (A. Deyaert); Labelle; Punta Gorda; Royal Palm Park and Dunedin (W. S. Blatchley); St. Petersburg (H. Raster); Miami Beach (S. O. Hill); Biscayne Bay (Mrs. A. T. Slosson); Kissimee; Coconut Grove, Long Pine Key (Wheeler).

Creighton, in his recent revision of the Neotropical *Solenopsis*, regards the common Florida form of *geminata* as identical with the Indian and East Indian form originally described by Perdon.

- (47) *Solenopsis (Diplorhoptrum) picta* Emery—Paradise Key, Long Pine Key, Lower Matacombie Key (Wheeler), in hollow twigs of trees and shrubs and in the culms of sedges.

According to Emery this ant, which Emery described from Florida specimens taken by Pergande in a Cynipid gall on *Quercus phellas*, was erroneously identified as *S. tenuis* by Mayr in 1886 (not *tenuis* Mayr, 1877).

- (48) *Solenopsis (Diplorhoptrum) laeviceps* Mayr (?)—Dunedin (W. S. Blatchley).

This is probably *S. picta* Emery.

- (49) *Myrmecina graminicola* Latr. subsp. *americana* Emery var. *brevispinosa* Emery—Royal Palm Park (W. S. Blatchley).
- (50) *Antillæmyrmex floridanus* Wheeler—Royal Palm Park, Paradise Key (Wheeler), in dead twigs of a bush about six feet above the ground.

This interesting member of a genus hitherto supposed to be confined to the Antilles, was described in my recent paper "Ants of the Genera *Macromischa*, *Cræsomymex* and *Antillæmyrmex*," Bull. Mus. Comp. Zool., 1931, 72, p. 27.

- (51) *Leptothorax (Dichothorax) floridanus* Emery—"Florida" (T. Pergande), type locality.
- (52) *Tetramorium guineense* Fabr.—Dry Tortugas (T. Pergande); Biscayne Bay (Mrs. A. T. Slosson); Royal Palm Park and Dunedin (W. S. Blatchley).

A common tropicopolitan species introduced into Florida.

- (53) *Tetramorium simillimum* F. Smith—There are specimens bearing the label "Florida" in my collection. This is also an introduced tropicopolitan species.
- (54) *Wasmannia auropunctata* Roger—Miami (R. H. Hicks); Coconut Grove (D. Fairchild, Wheeler); Ft. Lauderdale (L. O. Hill).

This ant, apparently of recent introduction from the West Indies, where it is called the "hormiguilla" (Porto Rico) or "satana" (Cuba), is now very abundant under stones in the vicinity of Miami. Though minute and rather sluggish it can nevertheless sting somewhat painfully and may become a nuisance in gardens and plantations.

- (55) *Cryptocerus (Cyathocephalus) varians* F. Smith—Key West (T. Pergande); Card's Point (Wheeler), in Tillandsias; Coconut Grove (Miss Nancy Fairchild, Wheeler), in hollow twigs of *Coccoloba uvifera*).
- (56) *Cyphomyrmex rimosus* Spinola subsp. *minutus* Mayr—Key Largo, Coconut Grove. Long Pine Key (Wheeler); Miami (A. E. Wight); Royal Palm Park and Long Pine Key (W. S. Blatchley).

Forming small fungus-gardens under stones in shady places. The peculiar fungus (*Tyridiomyces formicarum* Wheeler) is

non-mycelial and is grown on particles of insect excrement collected by the ants.

- (57) *Trachymyrmex septentrionalis* McCook var. *seminola* Wheeler—Coconut Grove (Wheeler); Miami (A. E. Wight).

Making crater nests in the soil of open woods and lawns. The fungus, a white mycelium, is grown on suspended masses of vegetable detritus in chambers some inches beneath the surface.

Subfamily Dolichoderinae

- (58) *Dolichoderus (Hypoclinea) plagiatus* Mayr var. *beutenmuelleri* Wheeler—Pablo Beach (P. Laurent).
(59) *Dolichoderus (Hypoclinea) plagiatus* subsp. *pustulatus* Mayr—Long Pine Key (W. S. Blatchley, Wheeler).

Blatchley found his specimens "nesting beneath loose bark of pine on Long Pine Key, and beneath boards on the ground near the old tomato packing shed. Also swept from weeds in old fields." In the same locality I found this ant nesting in the stems of sedges. Males and winged females were present in all the colonies during late December and early January.

- (60) *Iridomyrmex humilis* Mayr—Gainesville, Sept. to Oct., 1914.

This, the "Argentine ant," is represented in my collection by a single specimen from the locality above mentioned.

- (61) *Iridomyrmex pruinosus* Roger—Royal Palm Park and Long Pine Key (W. S. Blatchley); St. Petersburg (H. Raster); Key Largo, Lower Matacombie Key, Paradise Key (Wheeler); Titusville (Amer. Mus. Nat. Hist.).
(62) *Dorymyrmex pyramicus* Roger—Miami (A. E. Wight); Upper and Lower Matacombie Keys (Wheeler). Recorded by Mayr and Emery from Florida.
(63) *Dorymyrmex pyramicus* var. *flavus* Pergande—Tallahassee; Monticello; Lakeport (A. Deyaert); Pensacola; Gainesville; Miami (A. E. Wight); Miami Beach, Hollywood; Coconut Grove (Wheeler); Dunedin (W. S. Blatchley).

Nesting in crater nests in sandy soil or beach sand.

- (64) *Tapinoma sessile* Say—Royal Palm Park (W. S. Blatchley, Wheeler); Titusville (Amer. Mus. Nat. Hist.).

In the Northern States this common ant nests in the ground under stones, bits of wood, etc., but the single colony which I found in Royal Palm Park was inhabiting the basal portion of a large *Cladium effusum* culm. The specimens are rather pale, with yellowish mandibles and body sutures, the pubescence is somewhat more developed and the integument therefore less shining than in many forms of *sessile*, but till the species has been revised I hesitate to introduce a new varietal name.

- (65) *Tapinoma (Micromyrma) littorale* Wheeler—Miami, Coconut Grove, Paradise Key, Long Pine Key, Card's Point (Wheeler); Miami (A. E. Wight); Dunedin (W. S. Blatchley).

Nesting in dead twigs or in Tillandsias.

- (66) *Tapinoma (Micromyrma) melanocephalum* Fabr.—Royal Palm Park (W. S. Blatchley); St. Petersburg (H. Raster); Miami (A. E. Wight), in Tillandsias; Biscayne Bay (Mrs. A. T. Slosson).

A common tropicopolitan ant, the "hormiga bottegaria" of the West Indies.

Subfamily Formicinae

- (67) *Brachymyrmex heeri* Forel var. *depilis* Emery.

A common northern variety cited by Emery as occurring in Florida.

- (68) *Camponotus castaneus* Latr.

Forel and Mayr record this species from "Florida" (Mrs. Mary Treat). I have several workers from Monticello, Jefferson County, in the extreme northern portion of the state.

- (69) *Camponotus castaneus* subsp. *americanus* Mayr.

Workers from Quincy, Gadsden County (W. A. Hooker), also in the extreme northern portion of Florida. This is probably the southernmost limit of the range of this subspecies, which occurs as far north as Massachusetts.

- (70) *Camponotus herculeanus* L. subsp. *pennsylvanicus* Degeer.

A few workers of this common northern carpenter ant from Tallahassee (L. S. Barber).

- (71) *Camponotus (Tanaemyrmex) tortuganus* Emery—Dry Tortugas (T. Pergande), type-locality; Miami, Coconut

Grove, Paradise Key, Long Pine Key, Planter on Key Largo (Wheeler); Lake Worth (J. Schmitt); Marco; Everglade; Royal Palm Park, Paradise Key (W. S. Blatchley); Gulfport (Reynolds).

These localities are all in the southern third of the peninsula. *C. tortuganus* forms rather small colonies under stones. In the "Genera Insectorum" Emery doubtfully cites it as a subspecies of *C. conspicuus* Smith, but it seems to me preferable to regard it as an independent species.

(72) *Camponotus* (*Tanæmyrmex*) *incensus* sp. nov.

WORKER MAJOR. Length about 7 mm.

Resembling *tortuganus* but much smaller; (the latter measures 10–11 mm.) head of the same shape but proportionally shorter, with more acute anterolateral clypeal angles, more nearly straight, crenated anterior clypeal border, less impressed frontal area, posteriorly more approximated frontal carinæ and somewhat shorter and more compressed antennal scapes. Thorax distinctly shorter with more convex and more even dorsal curvature, broader through the pronotum, which is less flattened above; base of epinotum forming a more distinct angle with the declivity. Grooves of the hind tibiæ less distinct. Surface of body less sharply shagreened, so that the surface, especially of the occiput, posterior corners of the head and the thorax distinctly smoother and more shining. Cheeks and sides of head with sparse but shallow, elongate foveolæ or coarse punctures, occiput with a radiating series of linear punctures and dorsal surface of pronotum with several similar impressions. Pilosity as in *tortuganus*, but paler yellow and pubescent on legs shorter. Color similar but the thorax is paler and more yellowish and the occiput and posterior corners of the head are paler, reddish brown. Gaster brown, paler than in *tortuganus*, the segments with a narrow dark brown band near the pale posterior border.

WORKER MINOR. Length 6.3 mm.

Very similar to the minor of *tortuganus* but much smaller and paler, the epinotum distinctly more angulate in profile, the base straight and nearly concave, the declivity very short. Thorax paler than in *tortuganus*, front, clypeus and cheeks anteriorly yellow, mandibles brownish yellow; gaster colored like that of the major.

Described from a single major and two minor workers which I collected many years ago (May 6, 1904) on Pigeon Key, near Miami, Florida

(73) *Camponotus* (*Tanaemyrmex*) *Sosius* Roger—Sanford (J. Schmitt); Green Cove Spring (Mrs. Mary Treat); Dunedin (W. S. Blatchley); De Funiak Springs; Estera; Tampa; Clearwater; Kissimee.

This handsome species has a singular distribution since it is known to occur only in Brazil, Florida, Georgia and Alabama. In none of these localities does it seem to be abundant.

(74) *Camponotus (Tanæmyrmex) socius* var. *osceola* var. nov.

WORKER MEDIA and MINOR. Differing from the typical *socius* in color. The ferruginous red of the head, thorax and appendages is much paler, with different maculation of the gaster. The dorsal surface of the first to third gastric segments is largely pale yellow, separated from the pale posterior border by a narrow dark brown band. In the typical *socius* there is no yellow spot on the third segment and the one on the second is nearly interrupted in the middle.

Four specimens from Jacksonville, Florida (Van Duzee Coll.).

(75) *Camponotus (Myrmothrix) abdominalis* Fabr. subsp. *floridanus* Buckley—Lake Worth; Miami (A. E. Wight); Coosahatchie River (Heil); Royal Palm Park (W. S. Blatchley, Wheeler); Key Largo, Coconut Grove, Lower Matacombie Key, Hollywood, Long Pine Key (Wheeler); St. Petersburg (H. Raster); Ft. Myers (S. O. Hill); Cocoa (H. T. Woodruff); Gainesville; Monticello; Labelle. Clearwater; Kissimee.

This common and pugnacious ant has a great variety of nesting sites—in dead branches on living trees, in decaying logs, under large stones, boards, etc. It is known to plunder bee-hives.

(76) *Camponotus (Myrmentoma) caryæ* Fitch—Tallahassee (L. S. Barber); Atlantic Beach (Mrs. A. T. Slosson); Live Oak (A. P. Morse).

Nesting in dead branches.

(77) *Camponotus (Myrmentoma) caryæ* subsp. *rasilis* Wheeler—Miami (Wheeler); Sanford (J. Schmitt); Royal Palm Park (W. S. Blatchley).

(78) *Camponotus (Myrmentoma) caryæ* subsp. *rasilis* var. *pavidus* Wheeler—Jacksonville and Atlantic Beach (Mrs. A. T. Slosson); St. Augustine (C. T. Brues).

(79) *Camponotus (Myrmobrachys) planatus* Roger—Miami (Wheeler, A. E. Wight); Fort Myers (S. O. Hull); Card's Point, Planter on Key Largo, Cocoplum Beach near Coconut Grove, Lower Matacombie Key, Miami Beach (Wheeler); Upper Matacombie Key (W. S. Brooks); Key West (T. Pergande).

This tropical ant, which is common in Cuba and Mexico, nests either in the hollow branches of trees, especially *Coccoloba uvifera*, in the stems of weeds or in Tillandsias. It is confined to the southern third of the peninsula.

- (80) *Camponotus (Colobopsis) impressus* Roger—Lake Worth J. Schmitt; Bellair (Mrs. A. T. Slosson); Dunedin and Royal Palm Park (W. S. Blatchley); Paradise Key, Long Pine Key and Pine Crest (Wheeler).

I found this ant very common in the culms of sedges. It nests precisely like *C. culmicola* Wheeler of the Bahamas. Males and winged females were present in most of the colonies during late December and early January.

- (81) *Camponotus (Colobopsis) pylartes* Wheeler.

Dr. M. R. Smith records this species as having been taken by W. S. Blatchley in Royal Palm Park.

- (82) *Paratrechina longicornis* Latr.—Miami (A. E. Wight); Coconut Grove (Wheeler); Royal Palm Park (W. S. Blatchley); St. Petersburg (H. Raster).

A common tropicopolitan and introduced species, the "crazy ant" ("hormiga loca") of the West Indies.

- (83) *Paratrechina (Nylanderia) parvula* Mayr—Dunedin (W. S. Blatchley). Recorded by Mayr and Emery from "Florida."

- (84) *Paratrechina (Nylanderia) vividula* Nylander—Gainesville; Miami (A. E. Wight).

- (85) *Paratrechina (Nylanderia) bourbonica* Forel var.—Miami Beach (S. O. Hill); Miami (A. E. Wight) Apr., May, 1924; Coconut Grove (Wheeler).

Of recent introduction from the Orient.

- (86) *Prenolepis imparis* Say var. *testamea* Emery—St. Augustine (C. T. Brues); Tallahassee.

Known only from the northern portion of the state; common as far north as New Jersey.

- (87) *Lasius niger* L. subsp. *alienus* Förster var. *americanus* Emery—Monticello. Mayr had already recorded this very common northern ant from "Florida."

(88) *Lasius brevicornis* Emery.

Recorded by Emery from "Florida," probably from one of the northern counties.

(89) *Lasius* (*Acanthomyops*) *claviger* Roger.

Recorded by Emery from "Florida." Like the preceding it probably occurs only in the northern counties.

(90) *Formica* (*Neoformica*) *pallide-fulva* Latr.—St. Petersburg; Gainesville.

(91) *Formica* (*Neoformica*) *pallide-fulva* Latr. subsp. *schaufussi* Mary var. *dolosa* Wheeler—Monticello; Gainesville; Pensacola (J. C. Bradley); St. Petersburg (H. Raster).

COLLECTING HYPOCHILUS

BY ALEXANDER PETRUNKEVITCH

PROFESSOR OF ZOOLOGY IN YALE UNIVERSITY

Among the numerous species belonging to a definite order of invertebrate animals there are always a few which are difficult to classify. In the case of such forms as parasitic Crustacea the characters of the adult may become effaced, modified or even completely obliterated by parasitic life. In other cases structures characteristic of separate families may be present in the same species, making the assignment of the species to the one or the other family a matter of individual judgment. In such cases a more extensive study of the anatomy, embryology and mode of living may give real help in reaching a correct decision. The matter may be more complicated when the problem of phylogeny is drawn in and the question arises whether the structures under consideration are of ancestral type or of more recent acquisition. This is so in the case of *Hypochilus*, one of the most interesting spiders in the United States.

Hypochilus was discovered by Marx in 1888, who at once recognized its peculiar position. The specimens which he examined were collected by Dr. Fox in July of that year in the vicinity of Lookout Mountain, near Chattanooga, Tennessee. Marx noticed its resemblance to *Pholcus*, but the presence of four lungs, of a cribellum in front of the spinnerets and a calamistrum on the fourth metatarsi led him to the establishment of a new and distinct Family *Hypochilidae* with a single species *Hypochilus thorelli*. An attempt to unite the family with Theraphosid spiders in a Sub-order *Tetrapneumones* has been revived by Dahl as recently as 1913, but the majority of the arachnologists place it at present with the true spiders in the Sub-order Arachnomorphæ. No new knowledge has been added concerning the spider since the time of Marx. Banks has recorded it from Paint Rock, Balsam and Sugar Fork of the Swannanoa River, in North Carolina. Comstock received specimens from Tallulah

Falls, Georgia, and published a photograph of a typical locality, made for him by Dr. Fox in the "Walden Ridge" without more definite reference to the geographical position. In 1888 Simon described a spider from southern China under the name of *Hypochilus davidi*, but in 1892 removed it to a new genus *Ectatosticta*. The interest in the status of the family was further enhanced by Simon, when in 1902 he described another species, *Ectatosticta australis*, from Tasmania. This species was later found to be synonymous with *Theridion troglodytes* Higg. et Pett. and is now listed as *Ectatosticta troglodytes*.

Thus in 1931 we find ourselves in the possession of very meager information concerning this peculiar family which comprises only three species from widely separated geographical regions, a family distinct from every other family of spiders, yet combining characters of two sub-orders, waiting for some one to make a more comprehensive study than the mere external description sufficient for identification of the species. It was long my desire to undertake such a study and this summer, owing to a grant from the Sigma Xi Society I was enabled to go South to collect the material. The results of the study will be published later in a special article on the subject.

I left New Haven on July 16th in company with Dr. G. E. Pickford who was collecting earthworms for her own studies, and proceeded to Mountain Lake in Virginia where we were joined by Professor and Mrs. Valentine, of Chapel Hill, N. C. We first visited White Top Mountain from the summit of which one gets an extensive view into Virginia, Tennessee and North Carolina. Although there are numerous rocks and ledges at different elevations on the mountain, no *Hypochilus* was found. The night was spent in a cabin near the summit and next morning we proceeded to Little Switzerland in North Carolina where we found comfortable lodgings in the charming Swiss Chalet. Careful search within a radius of about two miles did not disclose the presence of any *Hypochilus*, but *Cybaeus giganteus* Banks was common everywhere along the roads, on exposed rocks, clay banks, tree trunks, etc. We now took the road towards Asheville, N. C., and 22 miles from there for the first time struck a locality abounding in *Hypochili*. We first noticed the webs on ledges

situated a few dozen feet from the road by a little brook, over a dozen of them in fairly close proximity to each other. The webs, previously described by Marx and Comstock, are so characteristic and so different from webs of all other spiders, that they are easily detected without danger of confusion from an automobile moving at a moderate speed. While I was making photographs of the webs and ledges, Drs. Pickford and Valentine collected for me numerous specimens of various ages in a small ravine below the road. We did not attempt to collect between this locality and Highlands where we were due to arrive the same evening and where we actually arrived late after dark on account of tire trouble.

Highlands is situated in Macon County close to Georgia and South Carolina at an elevation of somewhat over 3,800 feet, and is surrounded by forests with deep gorges everywhere abounding in Hypochili. In fact, Hypochilus is here the second commonest spider, the only more common one being *Cybaeus giganteus*. Numerous webs were found near Linden Lake, on the trail to the Primeval Forest, on the road to Franklin, on the road to Cashiers and on the road to Dillard. The webs were especially abundant on ledges by the Cullasaja Falls, four miles from Highlands. We spent four delightful days in the company of Dr. Reinke, Director of the Sam T. Weyman Memorial Laboratory, and were deeply impressed by the potentialities of this locality for biological study. During that time we preserved many specimens of Hypochilus in fixing fluids for future microscopic study, others in alcohol for my collection and captured seventy living specimens which were put into individual aluminum containers for transportation to New Haven.

From Highlands we made a side trip to Tallulah Falls, Ga., where we inspected the gorge abounding in ledges with innumerable webs of Hypochili. The elevation here is only 1,600 feet but the ledges are of the same type as in the vicinity of Highlands. The descent is exceedingly steep and many ledges are practically inaccessible. Tallulah Falls is the southernmost locality which we visited. We now decided to go to the Walden Ridge, which as stated above, is mentioned in Comstock's Spider Book without reference to a more definite locality. We went by way of Frank-

lin, Dillsboro and Bryson City and then through the Nantahala river valley, where we found again numerous *Hypochili* at an elevation of about 2,000 feet. Occasional search of ledges between Topton and Murphy did not reveal the presence of any *Hypochili* and the perfectly bare ground of red clay around Ducktown is quite unsuitable for the life of this spider. We were rather surprised not to see any webs on the ledges along the Kimsey Highway in the Beans Mountains although the conditions seem to be suitable for their existence there.

The Walden Ridge follows the western bank of the Tennessee River by which it is separated in the south from Lookout Mountain. It is much drier than the mountains which we had visited before and is separated from the Beans Mountains by the broad valley of the Tennessee River. As one motors north from Chattanooga to Dayton, one observes numerous ledges close to the top of the ridge. Intending merely to verify the presence of *Hypochilus* in the Walden Ridge, we ascended it only at one place, namely, by the road from Dayton to Morgan Springs. Here we found indeed numerous *Hypochili* at an elevation of 1,600 feet, although the woods and ledges were fairly dry. On one ledge abounding in webs of *Hypochili* we found also a large gravid female *Epeira cavatica* and a mature male *Marpissa californica*, the latter recorded now for the first time from Tennessee.

Whether *Hypochilus* occurs further north on the Walden Ridge we do not know, because we now left it for the Great Smokies by way of Sweetwater, Madisonville, Maryville and Gatlinburg. Twenty-two miles beyond Maryville we encountered numerous specimens on ledges near the road in the Chilhowee Mountains at an elevation of 1,150 feet and webs could be seen from here on along the road to Gatlinburg. Webs were also numerous on the Indian Gap road up to an elevation of 4,500 feet, but none were seen higher up. Our route lay by way of Sevierville and Newport to Hot Springs, Trust and Cross Rock. A little beyond Hot Springs we saw again numerous webs and collected specimens almost as far as Cross Rock, the elevation at one place having been measured as 1,700 feet. Going through Asheville to Spruce Pine and once more stopping for the night at Little Switzerland we started next day on our way to Mountain

Lake in Virginia. As before, we found no *Hypochili* on the road from Little Switzerland to Spruce Pine, but saw and collected three female *Latrodectus geometricus* with cocoons. The first point at which we again encountered webs of *Hypochili* was beyond Linville, about 15 miles from Blowing Rock on ledges by the road at an elevation of 4,100 feet and from here on for about a mile along the Watauga River. This was the last locality at which we saw *Hypochili* and although the road through Boone to Independence and Wytheville crosses the Unaka National Forest and has many ledges, no webs were seen here.

From the data obtained on this collecting trip the main geographical area inhabited by *Hypochilus* may be represented as a triangle with its apex at Blowing Rock, N. C., and its base extending from Maryville, Tenn., to Tallulah Falls, Ga. This area encloses the Great Smokies, the Nantahala Mountains, and the southern half of the Blue Ridge. Lookout Mountain and the Walden Ridge lie considerably to the west of this area and represent probably the westernmost extension in the distribution of *Hypochilus*. A considerable gap lies between this and the eastern area, so far without any indication as to the manner or path by which the invasion of this narrow strip has been accomplished.

THE NORTH AMERICAN SPECIES OF THE GENUS
LIMNOPHORA ROBINEAU-DESVOIDY, WITH
DESCRIPTIONS OF NEW SPECIES
(MUSCIDÆ, DIPTERA)

BY H. C. HUCKETT
RIVERHEAD, N. Y.

INTRODUCTION

The genus *Limnophora* Robineau-Desvoidy comprises a large group of flies that are not familiar to collectors in North America except for their apparently uninteresting appearance. They are to be met with usually in the vicinity of water, especially along rivers and lakes, the immature forms presumably living an aquatic or semi-aquatic existence. On the other hand, the species belonging to the group *Gymnodia* Robineau-Desvoidy are commonly found near decay and filth, resembling the muscoid flies in habit.

The object of the present study is to bring together as completely as possible the records of species known to occur in North America with a view to facilitating their study and recognition. Numerous collections have been examined, and it is evident generally that there has been a considerable amount of misidentification, and that there are yet a number of species to be recorded. The fragmentary nature of the literature has also been a serious bar to further progress and interest.

The writer has had the privilege of examining the large faunal collections made by Dr. J. M. Aldrich in the Rocky Mountains and Alaska, by Dr. A. L. Melander, Mr. H. L. Seamans, and Mr. C. B. D. Garrett in the Rocky Mountains, by Mr. C. W. Johnson in the New England States, and by the late Professor J. S. Hine in Alaska.

The collections in the following institutions have been examined through the generous assistance of their keepers; the United States National Museum, Washington; Cornell Univer-

sity, Ithaca; the American Entomological Society, Philadelphia; the Boston Society of Natural History, Boston; the Canadian National Collection, Ottawa; the American Museum of Natural History, New York; the Field Museum, Chicago; and that of the Illinois State Natural History Survey, Urbana. I also have been privileged to examine the private collection of Dr. A. L. Melander, and of the late Professor J. S. Hine. Dr. E. P. Van Duzee has very kindly forwarded paratype material from the collection of the California Academy of Sciences, San Francisco.

I wish also to acknowledge the valuable advice and information offered by Dr. J. M. Aldrich, Dr. O. A. Johannsen, Dr. J. Villeneuve, and Mr. E. Séguy concerning the nomenclatorial problem arising from the unsatisfactory status of the generic name *Limnophora*.

To Mr. O. Ringdahl I am deeply indebted for the invaluable help and advice proffered concerning the identification of subarctic forms. Much of the new material was sent to Mr. Ringdahl for examination and comparison with Scandinavian forms.

I have also had considerable help from Mr. J. E. Collin in the identification of species occurring in Baffin Land and Greenland. In addition Mr. Collin has very kindly made the necessary comparisons of North American material with Walker's types in the British Museum, thereby rendering it possible to establish once more the identity of these little known species.

Mr. Collin has provided me with a list of species that he has recognized as occurring in Greenland, many of which I have not had the opportunity of studying. A few of these species are included in the records that follow, having been sent to Mr. Collin for study. The remaining species are listed at the close of the paper. All of these species are included by Mr. Collin in a paper on the Greenland species of *Limnophora* that has recently been published in the Transactions of the Entomological Society of London (6a).

EXPLANATION OF TERMS USED IN KEYS AND DESCRIPTIONS

Every effort has been made to discover additional, tangible characters among species that are apparently difficult to distinguish under the best of circumstances. A few such have been

grasped and used in the hope that they may be of some use in studies of a limited nature. Whether such characters will survive the test of wider application is entirely questionable.

The following explanations are offered with a view to aiding in the detection of little known characters that may be mentioned, to clarify the descriptive terminology used, and to assure a common understanding when making measurements.

Unless otherwise stated, the measurement between the eyes is taken at the narrowest distance of separation, which is usually at middle of frons; the breadth of parafacial is measured at base of antennæ when the head is viewed in profile; the height of cheek is taken at the narrowest distance between the margin of eye and the ventral border of head, at a point previous to the upward curvature of the head capsule defining the occipital and genal regions.

The oral margin is said to be protruded beyond the base of antennæ when projecting beyond a line drawn in a vertical plane from the most anterior part of parafacial. In other words, when the head is viewed in profile, the axis of the head capsule at a level with the oral margin is greater than that at a level with base of antennæ.

The mesonotum, unless otherwise stated, is viewed from above and in front.

The accessory bristles of the mesopleural series of bristles occur in the marked intermission between the dorsal and following bristles in the series. This interspace is bare in many species, and is filled by one or more weaker bristles in a few species, *e.g.*, (*Spiligona*) *aerea* (Zetterstedt), *novæ-angliæ* Malloch, *imitatrix* (Malloch).

The scutellum of many species in the subgenus *Spilogona* Schnabl and Dziedzicki possesses one or more setulose hairs which are appressed and directed caudad. These hairs are situated on the dorsal margin of lateral declivities adjacent the apical bristles, *e.g.*, (*S.*) *aerea* (Zetterstedt), *rufitibia* Stein, *obscuripennis* Stein. On the other hand such scutellar hairs are not present in (*S.*) *narina* (Walker), *alticola* Malloch, *torreyæ* Johannsen, and *suspecta* Malloch.

The abdomen is viewed from above and behind unless otherwise stated.

The first visible tergum is designated as terga 1 + 2, the second as tergum three, the third as tergum four, and the fourth as tergum five.

The basal sclerite of hypopygium is situated immediately caudad of tergum five.

The veins of the wings have been named according to the system introduced by Comstock and Needham (7),* and is as follows:—

First longitudinal vein	= Radius I.
Second longitudinal vein	= Radius 2 + 3.
Third longitudinal vein	= Radius 4 + 5.
Fourth longitudinal vein	= Media 1 + 2.
Fifth longitudinal vein	= Media 3 plus Cubitus I.
Sixth longitudinal vein	= Cubitus 1 plus first Anal.
Anterior cross vein	= Radius—Media cross vein.
Posterior cross vein	= Media—Cubitus cross vein.

Genus *Limnophora* Robineau-Desvoidy

Limnophora Robineau-Desvoidy, Essai Myodaires, 1830 p. 90.—Macquart, Hist. Nat. d. Ins., 1835 II p. 309.—Schiner, Fauna Austr., 1862 I p. 621—Rondani, Della Soc. Ital. Scienze Naturali, 1866 IX pp. 72 . 137.—Rondani, Dipt. Ital., Prodr., Part V 1877 pp. 11 . 103.—Osten Sacken, Misc. Coll. Smithsn. Inst., 1878 III p. 167.—Meade, Ent. Month. Mag., 1881 XVIII p. 101.—Bigot, Ann. Soc. Ent. France, 1883 (1882) ser. 6 II p. 18.—Schnabl, Horae Soc. Ent. Ross., 1890 (1889–1890) XXIV pp. 493 . 501.—Stein, Ann. Mus. Nat. Hungarici, 1904 II p. 459.—Aldrich, Misc. Coll. Smithsn. Inst., 1905 XLVI No. 1444 p. 546.—Stein, Katalog Paläark, Dipt., 1907 III pp. 669 . 673.—Williston, Manual of North America Diptera, 1908 3rd ed. p. 334.—Coquillett, Proc. U. S. Nat. Mus., 1910 XXXVI No. 1719 p. 561.—Schnabl, and Dziedziicki, Abh. d. Kaiserl. Leop.—Carol. Deutsch. Akad. d. Naturforsch., 1911 XCV Nr. 2 p.

* References are quoted in the text by a number in brackets, which refers to the corresponding number given to the literature cited in the list of references.

141.—Stein, Arch. f. Naturgesch., 1911 Abt. A Heft 1 pp. 111–137.—Stein, Arch. f. Naturgesch., 1914 (1913) Abt. A Heft 8 p. 26.—Stein, Arch. f. Naturgesch., 1916 (1915) Abt. A Heft 10 p. 83.—Johannsen, Trans. Amer. Ent. Soc., 1916 XLII No. 756 p. 391.—Ringdahl, Ent. Tidskr., 1918 XXXIX Haft 2 p. 158.—Stein, Arch. f. Naturgesch., 1919 (1917) Abt. A. Heft 1 p. 133.—Stein, Arch. f. Naturgesch., 1920 (1919) Abt. A Heft 9 p. 46.—Collin, Ent. Month. Mag., 1921 ser. 3 VII pp. 95–100.—Séguy, Faune de France, Part VI 1923 pp. 195–196.—Karl, Die Tierwelt Deutschlands, T. XIII 1928 pp. 91.92.

Cuculla Robineau-Desvoidy, Essai Myodaires, 1830 p. 523.—Stein, Katalog Paläark. Dipt., 1907 III p. 669.

Aricia Pandellé in part, Revue ent. France, 1899 XVIII p. 115.

The genus *Limnophora* was erected by Robineau-Desvoidy (40) in 1830 for the reception of twenty nominal species, fourteen of which are European and none of which, according to Collin (5), have ever been recognized by subsequent authors.¹ That the generic name is still in good use under these conditions exemplifies in a striking way the peculiar influence that tradition and expediency have exerted.

There have been three types designated for the genus. Robineau-Desvoidy (40) himself did not indicate that any one of the original species might be taken as the type. The species *palustris* is used as a basis for comparative description for others that follow in the list, and on this account might be regarded as a typical species of the genus. But there the matter rests since Robineau-Desvoidy's material has never been examined.

In 1866 Rondani (42) designated *Anthomyia compuncta* Wiedemann as the type of *Limnophora*, a species not included in the original series by Robineau-Desvoidy. Rondani evidently followed Macquart's (23) prior list of 1835 inasmuch as he repeats the names of the few original species belonging to the genus before citing *compuncta*. He apparently did not recognize any of the former species to warrant a type designation from

¹ Villeneuve and Séguy have also assured me by correspondence that the original material has never been recognized as such, and so far as they know it is not in existence.

among them. Both Meade (33) and Osten Sacken (36) record the statement that *Anthomyia compuncta* Wied. is the type of *Limnophora*.

In 1910 Coquillett (12) designated *Limnophora palustris* Robineau-Devoidy as the type, the second species from the original series and the first of those recorded by Macquart and Rondani. It is very doubtful whether, under the circumstances, Coquillett had any definite knowledge regarding the identity of *palustris*. The most helpful opinion about the matter is given by Collin (5), who bases the appearance of the type on a comparison with the generic description. I can scarcely accept such an assumption regarding the identity of the species as proof of the genus.

In 1928 Karl (19) designated *Musca notata* Fallen² as the type of the restricted genus *Limnophora* of recent authors, which species thereby becomes the type of the genus *Limnophora sens.-lat.* However, as in the previous case of Rondani's designation, neither *compuncta* nor *notata* is included in the original series of species belonging to the genus, and hence their designation is invalid according to the rules of the International Committee on Nomenclature.

In conclusion, it may be said that in so far as a study of the literature reveals there has been no valid type designation that would fix the identity of the genus, largely, it is presumed, because none of the original species mentioned by Robineau-Desvoidy has been known to be available for study. Their existence appears to have ceased with the publication of their names. The permanent status of the generic name *Limnophora* will largely depend on fixing the type of the genus. It is to be hoped that whatever be the ultimate decision concerning the matter by fellow workers or by any authorized body due regard will be given to the feasibility of retaining the present generic name.

² Mr. Karl explains in a recent letter that the species denoted by him as "*typische art*" should be regarded as representative species for the group, his purpose being to suggest the name of well known species whereby students might be able the more readily to recognize the various groups. This did not necessarily involve the designation of the type species.

The genus *Limnophora sens.-lat.* contains numerous species from North America, many of which have been allotted to various genera at different times.

In 1835 Macquart (23) added nine European species to the original number, including *compuncta* Wiedemann and *triangula* Fallen of North American occurrence. The well known European species *Musca notata* Fallen was included by Macquart in his newly formed group *Spilogaster*. Schiner (44), Rondani (42), and Meade (34), followed Macquart's classification. but transferred the species *triangula* to the genus *Cænosia*.

In 1889, 1890, and 1902, Schnabl (45) (46) (47), presented contributions concerning the limitations of certain allied groupings, in which he restricts the use of the generic name to certain species of which *notata* and *triangula* are representative. In the light of more recent work, it appears that Schnabl's concept regarding the limitations of the groups are well founded, although from his own diagnostic descriptions such is difficult to interpret. He introduces the use of the male genitalic characters to confirm the contention of Strobl that the species included by him in the new genus *Pseudolimnophora* (61) are more closely related to *Limnophora* than to *Cænosia*, the commonly accepted genus at this time.

In 1911 Schnabl and Dziedzicki (49) produced their great work, *Die Anthomyiden*, in which the genus *Limnophora* is divided into seven subgenera, four of which occur in North America, namely, *Limnophora sens.-str.*, *Leucomelina* Macquart, *Brontæa* Kowarz, and the new subgenus *Spilogona*. The classification of the group is based largely on the more or less arbitrary nature of the characters exhibited by the shape of the genitalic appendages in the male sex. No types are designated.

Meanwhile in 1899 Pandellé (37) had retained the old group name *Aricia* to include four subgenera, including *Aricia*, *Spilogaster*, and *Limnophora*. To the two former segregates he imparts the species *notata* Fallen and *carbonella* Zetterstedt respectively. It is evident in glancing through the list of species that Pandellé's treatment of the various categories embraced something much wider in its application than what is credited to such rankings as genus and subgenus today.

Stein (55) (56) (57) (58) (59) in all his contributions to the faunal studies of the world has regarded the genus in its broadest meaning, not recognizing many of the lesser segregates of Schnabl and Dziedziaki, nor the limnophorine genera of Rondani and Strobl. He follows the traditional treatment of the genus, reserving it for such species as possess the following combination of characters: Abdomen invariably marked by paired subtriangular areas, male genitalic appendages not prominent, thorax with two pairs of presutural dorsocentral bristles, and with the sternopleural bristles not arranged in an equilateral triangle, prealar bristle absent, antennæ with bare or finely pubescent arista, hind tibia with no bristles on posterodorsal surface. Ringdahl (39) has followed Stein in the treatment of the Swedish forms of *Limnophora*. This generic concept forms the basis for the present classification of the species from North America.

In 1918 and 1921 Malloch (26) (28) unintentionally redefined Schnabl and Dziedziaki's conception of the subgenus *Limnophora*, with possibly minor differences, raising the group to full generic rank. He based his conception of the genus on an entirely new set of delimiting characters. The large number of species formerly accredited to the genus he (28) placed under the generic name *Melanochelia* Rondani, a mistake for the name *Spilogona*, as later recognized by him (31).

In 1921 Collin (5), working independently, also redefined the segregates comprising the genus, using identically the same characters introduced by Malloch to restrict the group *Limnophora*, namely the presence of hairs along the lateral margins of prosternum and base of vein *R.* 4+5. In addition Collin attempted to fix the segregates by depicting the probable nature of *palustris* Robineau-Desvoidy, and by designating *compuncta* Wiedemann as the type of *Spilogona*. In treating of the European genera I have generally accepted the synonymy indicated by Collin.

Séguy (51) in 1923 and Karl (19) in 1928 used the characters adopted by Malloch and Collin to classify the species of *Limnophora sens.-lat.* occurring in France and Germany respectively.

There are four nominal genera described from North America which are closely related to the genus *Limnophora*.

In 1913 Malloch (25) described the genus *Paralimnophora* for the reception of the single new species, *P. brunnesquama* (= *narina* Walker), the specimens being taken in New Hampshire, New Brunswick, and Quebec. Stein (59) has pointed out that the generic name is preoccupied. There appear to be no characters of sufficient significance to warrant the separation of the genus from *Spilogona*.

In 1918 Malloch (26) introduced the new genus *Bucephalomyia* with the species *Tetramerinx femorata* Malloch as type.

In 1919 Aldrich (2) erected the genus *Sphenomyia* for the reception of the single new species, *S. kincaidi*, taken in Alaska. There are two species referable to this genus, *kincaidi* and *biquadrata* (Walker). The males resemble those of *Spilogona leucogaster* (Zetterstedt), differing generically in that the wing vein *R*. 4+5 has a few setulæ towards base.

In 1920 Malloch (27) described the two genera *Eulimnophora* and *Lispoides*, with the types *Limnophora arcuata* Stein and *Limnophora æquifrons* Stein respectively, both species being of wide distribution in North America. The former genus is now considered by Malloch (32) as a synonym of *Gymnodia* Robineau-Desvoidy.

I have refrained from including Schnabl's genus *Limnospila* (48), containing the single palæarctic species *L. albifrons* (Zetterstedt), as a component part of *Limnophora*, despite the fact that the species naturally belongs to the *Limnophorinæ* rather than the *Cænosiinæ*, because I am not certain regarding the relationship of the genus to other genera, such as *Tetramerinx* Berg. Artificially the genus may be separated from *Limnophora* by the position of the sternopleural bristles, which are situated in the form of an equilateral triangle, as in *Tetramerinx*. I am inclined to believe that this single character can no longer serve the purpose of delimiting the *Cænosiinæ* from the *Limnophorinæ*.

The first formal attempt to list the North American species belonging to the genus *Limnophora sens.-lat.* was in 1878 when Osten Sacken published his catalogue of North American diptera. The family *Anthomyiidae* contained largely the names of Walker's species from Canada and the United States, those of Loew's from North America, the determinations of material sent

by Professor Hagen of the Museum of Comparative Zoology, Cambridge, to Mr. Meade in England, and of records of species mentioned by Holmgren (15) as occurring in Greenland. There are eleven or twelve nominal species listed, which are scattered among the genera *Aricia*, *Eriphia*, *Hylemyia*, *Limnophora*, and *Anthomyia*.

In 1898 Stein (54), working on the collections of Hough, Aldrich, Johnson, and Nason, recorded six species of *Limnophora*, and in 1920 (60), with a second consignment of material from Aldrich, Johannsen, Bradley, and Melander before him, recognized eighteen additional species, and gave a key to twenty-one North American forms.

In 1905 Aldrich (1) published his catalogue of North American diptera, which not only incorporated the records of Osten Sacken, but also brought together the faunal lists of Slosson (52), Bigot (3), Williston (64), Coquillett (9), and Stein (54), besides the Mexican records of Giglio-Tos (15), and Van der Wulp (62). Excluding the Mexican species, there are seventeen species listed in *Limnophora*, one in *Cænoscia*, and three in *Spilogaster*, making a total of twenty-one species.

In 1921 Malloch (28) published his keys to the genera *Melanocheilia* (Malloch not Rondani) and *Limnophora sens.-str.*, recording therein many of the species described by him. In the former group there are twenty-four species included, whilst in the latter four.

More recently Johnson (18) has listed seventeen species from New England, included in the groups *Lispoides*, *Limnophora*, *Spilogona*, and *Paralimnophora* Malloch; and Leonard (21) has recorded fifteen species in the New York State list of insects.

In the following pages there are listed the records of eighty-one species and two varietal forms. Mr. Collin (6a) has recorded twelve additional species occurring in Greenland, which I have not been able to examine; likewise there are the records of five more species from North America which I am unable to verify owing to the fact that the material has not been available for study. In all there must be about one hundred species so far recognized as occurring in North America.

Of the species that have been studied there are three in *Limnophora*; two in *Pseudolimnophora*; two in *Sphenomyia*; one

in *Bucephalomyia*; one in *Lispoides*; three in *Gymnodia*; and sixty-eight species and two varieties in *Spilogona*. Of these, thirty-four constitute additional records for North America, and twenty-nine are described as new to science.

KEY TO SUBGENERA

1. Vein *R.* 4+5 with a few setulæ at base on dorsal or ventral surface of wing 2
- Vein *R.* 4+5 with no setulæ at base on dorsal or ventral surface of wing 5
2. Prosternum with a series of hairs along lateral margins 3
- Prosternum with no series of hairs along lateral margins 4
3. First abdominal sternum with no setulæ.
Limnophora Robineau-Desvoidy
- First abdominal sternum with setulæ *Pseudolimnophora* Schnabl.
4. Frontal vitta with a black polished triangular area, small and confined to vicinity of ocellar triangle in male, large and extending to base of antennæ in female; sternopleural bristles arranged in the order 1:1; hind tibia with an apical anterodorsal bristle *Sphenomyia* Aldrich
- Frontal vitta pollinose, with no polished triangular area; sternopleural bristles arranged in the order 1:2; hind tibia with no apical anterodorsal bristle *Bucephalomyia* Malloch
5. Parafrontal setulæ descending on parafacials to a level below that of base of third antennal segment *Lispoides* Malloch
- Parafrontal setulæ not descending on parafacials to a level below that of base of third antennal segment 6
6. First abdominal sternum bare *Spilogona* Schnabl and Dziedzicki
- First abdominal sternum with a few setulæ 7
7. Eyes abnormally large and expansive when viewed in profile, reducing the parafrontals, parafacials, and caudal half of cheeks to lineal proportions; abdominal marks arcuate in outline; hind tibia with apical anterodorsal bristle absent *Gymnodia* Robineau-Desvoidy
- Eyes not restrictive of other parts of head owing to their abnormal size when viewed in profile; abdominal marks subtriangular or spherical in outline; hind tibia with apical anterodorsal bristle present.
Spilogona Schnabl and Dziedzicki

Subgenus *Limnophora* Robineau-Desvoidy

Limnophora Schnabl and Dziedzicki, Abh. d. Kaiserl. Leop.-Carol. Deutsch. Akad. d. Naturforsch., 1911 XCV Nr. 2 pp. 141. 151.—Malloch, Trans. Amer. Ent. Soc., 1918 XLIV No. 782 p. 274.—Malloch, Canad. Ent., 1921 LIII pp. 61. 64.—Malloch, Ann. Mag. Nat. Hist., 1921 ser. 9 VII p. 165.—Collin,

- Ent. Month. Mag., 1921 ser. 3 VII pp. 96 . 243.—Séguy, Faune de France, Part VI, 1923 pp. 196 . 199.—Malloch, Entomol. Mitteilung., 1928 Bd. XVII Nr. 4 p. 290.—Karl, Die Tierwelt Deutschl., T. XIII 1928 pp. 92 . 94.
- Leucomelina Macquart, Dipt. Exot., Suppl. 4, 1850 p. 234.—Bigot, Ann. Soc. Ent. France, 1883 (1882) ser. 6 XII p. 19.—Bigot, Ann. Soc. Ent. France, 1885 (1884) ser. 6 XIV p. 263.—Giglio-Tos, Boll. Mus. Zool. Anat. Comp. Univ. Torino, 1893 VII No. 147 p. 7.—Giglio-Tos, Ditteri del Messico, 1895 Pt. IV p. 18.—Van der Wulp, Biolog. Centr.-Americ., 1896 II p. 326.—Aldrich, Misc. Coll. Smiths. Inst., 1905 XLVI No. 1444 p. 548.—Williston, North American Diptera, 1908 3rd ed. p. 334.—Coquillett, Proc. U. S. Nat. Mus., 1910 XXXVII No. 1719 p. 560.—Schnabl and Dziedzicki, Abh. d. Kaiserl. Leop.-Carol. Deutsch. Akad. d. Naturforsch., 1911 XCV Nr. 2 pp. 141-150.—Malloch, Ent. News, 1921 XXXII p. 43.

The restriction of the genus *Limnophora* Robineau-Desvoidy to a more specific grouping of the species was first attempted by Schnabl (45) in 1889, to be followed by further contributions on the problem in 1890 (46) and 1902 (47). In 1911 Schnabl and Dziedzicki (49) published their important work, *Die Anthomyiden*, in which the relationship of the various segregates of *Limnophora* is set forth at some length. The group concepts were largely based on a series of arbitrary characters of which that of the male genitalia formed an important contribution. Fifteen European species and one varietal form are included in the subgenus *Limnophora*, most of which had heretofore been recorded by authors in such genera as *Limnophora sens.-lat.*, *Spilogaster*, *Aricia*, and *Cœnosia*. No type was designated for the new subgenus.

In 1918 and 1921 Malloch (28) redefined the group on the basis of an entirely new set of characters, restricting the group to those species with setulæ at base of vein *R*. 4+5, and with a series of hairs along lateral margins of prosternum. His concept of the group approaches that of Schnabl and Dziedzicki.

In 1921 Collin (5), working independently, used almost the same identical characters introduced by Malloch to classify the British species of *Limnophora*. He records Coquillett's prior

designation of *Limnophora palustris* Robineau-Desvoidy as type of the genus, and depicts the probable appearance of this species by a reference to the generic description of Robineau-Desvoidy.³ Séguy (51), with minor changes, followed Collin in the classification of the French species of *Limnophora*.

In 1928 Karl (19) designated the well known European species *Musca notata* Fallen as type of the subgenus *Limnophora*. This species conforms to the concept of the segregate as outlined by Schnabl and Dziedzicki, Malloch, and Collin according to Dr. J. M. Aldrich,⁴ but whether the species is conspecific with any of Robineau-Desvoidy's original species, including *palustris*, it is impossible to say definitely.⁵

In 1850 Macquart (24) established the genus *Leucomelina*, with the new Brazilian species *Leucomelina pica* as type. In his description of the genus Macquart drew attention to the character of vein *M*. 1 + 2, which he described as curved at apex, thus restricting the cell *R*. 5 at margin of wing. In 1885 Bigot (3) came to the conclusion that there was very little evidence for the retention of Macquart's genus, and favored its suppression and union with *Limnophora sens.-lat.* In 1893 and 1895 Giglio-Tos (13) described three additional Mexican species, and in 1896 Van der Wulp (62) revised the genus as restricted to Mexico, characterizing the genus as possessing the vein *M*. 1 + 2 distinctly curved at apex, in contrast to the entirely straight vein in *Limnophora*. In 1911 Schnabl and Dziedzicki (49) maintained the group as a subgenus of *Limnophora sens.-lat.*, separating it from *Limnophora sens.-strat.* by the distal curvature of vein *M*. 1 + 2. Stein (59), in listing the genera of the world, recorded the species of *Leucomelina* described by Macquart and Giglio-Tos among those of *Limnophora sens.-lat.*

Malloch (29), in re-examining Van Der Wulp's species, recognized the congeneric relationship between *Leucomelina* and *Limnophora* as restricted by him. He stated further that the *Limnophora* of Van Der Wulp contained three species that belong

³ I have already discussed the problem concerning the designation of not only this species but also that of *Musca notata* Fallen as types of *Limnophora* on page 29.

⁴ From an unpublished manuscript.

⁵ From correspondence with Dr. J. Villeneuve.

to *Leucomelina*, species which in common with many of those in Europe and North America have not the vein *M.* 1+2 curved forward at apex.

Numerous authors (44) (43) (34) (61) (37) have followed Macquart (23) in using the loosely constructed genus *Spilogaster* for the reception of one or more species of *Limnophora sens.-lat.*, notably in the case of *Musca notata* Fallen. Westwood (63) has designated *Musca quadrum* Fabricius as the type of the genus, a species which has been included by recent European workers in the genus *Helina* Robineau-Desvoidy.

Diagnostic characters:—Wing with a few setulæ at base of vein *R.* 4+5; prosternum with a series of hairs along lateral margins; first abdominal sternum with no setulæ; hind tibia with apical anterodorsal bristle lacking.

KEY TO SPECIES

1. Males 2
- Females 3
2. Eyes separated by a distance less than that between cephalic pair of parafrontal bristles; parafrontals with a series of bristles confined to cephalic half, and with a distinctive pair of setulose bristles adjacent the anterior ocellus: presutural acrosticals arranged in three or four irregular series: vein *M.* 1+2 curved more or less forward at apex, thereby narrowing the cell *R.* 5 at wing margin *narona* Walker
- Eyes separated by a distance greater than that between cephalic pair of parafrontal bristles, the latter weakly developed, and continued in an uninterrupted series to vertex: presutural acrosticals arranged in two irregular series: vein *M.* 1+2 straight to wing margin *discreta* Stein
3. Parafrontals at level of anterior ocellus narrower than distance between posterior ocelli: scutellum with a median brownish mark: vein *M.* 1+2 curved more or less forward at apex, thereby narrowing the cell *R.* 5 at wing margin *narona* Walker
- Parafrontals at level with anterior ocellus broader than distance between posterior ocelli: scutellum entirely grayish: vein *M.* 1+2 straight to wing margin 4
4. Mid tibia with a median anterodorsal bristle *groenlandica* Malloch
- Mid tibia with no median anterodorsal bristle *discreta* Stein

Limnophora (*Limnophora*) *narona* (Walker)

Anthomyia narona Walker, List Dipt. Brit. Museum, 1849 IV p. 945.—Osten Sacken, Misc. Coll. Smithsn. Inst., 1878 III p. 169.—Johnson, Proc. Acad. Nat. Sci. Phila., 1895 XLVII p. 336.

- Anthomyia prominula* Thomson, Dipt. Eug. Resa, 1868 p. 550.
- Homalomyia dentata* Bigot, Ann. Soc. Ent. France, 1885 (1884) ser. 6 IV p. 284. Aldrich, Misc. Coll. Smithsn. Inst., 1905 XLVI No. 1444 p. 538.
- Limnophora cyrtoneurina* Stein, Berl. Ent. Zeitschr., 1898 (1897) XLII p. 203.—Coquillett, Dipt. Invert. Pacif., 1904 I p. 33.
- Limnophora narona* Stein, Zeitschr. f. Hymen. u. Dipt., 1901 I Heft 4 p. 202.—Aldrich, Misc. Coll. Smithsn. Inst., 1905 XLVI No. 1444 p. 547.—Smith, Ann. Rept. N. J. State Mus. 1909, 1910 p. 791.—Stein, Arch. f. Naturgesch., 1911 Abt. A Heft 1 p. 132.—Johnson, Bull. Amer. Mus. Nat. Hist., 1913 XXXII Art. 3 p. 76.—Malloch, Trans. Amer. Ent. Soc., 1918 XLIV No. 782 p. 274.—Stein, Arch. f. Naturgesch., 1920 (1918) Abt. A Heft 9 pp. 47. 56.—Britton, Bull. 31 Conn. Geol. Nat. Hist. Surv., 1920 p. 198.—Malloch, Canad. Ent., 1921 LIII p. 64.—Cole and Lovett, Proc. Cal. Acad. Sci., 1921 XI No. 15 p. 311.—Johnson, Occ. Pap. Boston Soc. Nat. Hist., 1925 No. VII p. 229.—Huckett, Mem. 101 N. Y. (Cornell) Agric. Exp. Station, 1928 (1926) p. 834.
- Limnophora prominula* Thomson, Wien Ent. Zeitg., 1910 XXIX Heft 2 and 3 p. 67.—Stein, Arch. f. Naturgesch., 1919 (1917) Abt. A Heft 1 p. 136.
- Limnophora dentata* Stein, Arch. f. Naturgesch., 1919 (1917) Abt. A Heft 1 p. 134.

RECORDS:—

- Florida, 1 ♀, Palatka, May 3-4, 1916; 1 ♂, 4 ♀, Lakeland, May 6, 1916. (J. C. Bradley).
- Georgia, 2 ♂, 1 ♀, Spring Creek, Decatur Co., July 16-29, 1912; 3 ♂, 6 ♀, Billy's Island, Okefenokee Swamp, June, 1912.
- Tennessee, 1 ♂, Roan Mt., Carter Co., August 10, 1922. (T. H. Hubbell).
- Nevada, 1 ♀, Indian School, Pyramid Lake, July, 1911. (J. M. Aldrich).
- New Mexico, 1 ♀, Socorro,—(S. W. Williston): 1 ♂, 1 ♀, Las Cruces, June 15, 1917.
- California, 1 ♂, Los Angeles, Aug. 3—. (J. M. Aldrich): 2 ♂, Berkeley, Sept. 16, 1906: 1 ♂, Berkeley Hills, 500-1000 ft. Sept. 9, 1907; 1 ♂, Mesa Grande, Russian R., Sept. 30, 1906;

1 ♂, 1 ♀, Sisson, Aug. 14, 1908. (J. C. Bradley); 1 ♀, Fresno, Nov. 15, 1922. (E. Phillips): 1 ♀, Stanford U., Dec. 29, 1897; 2 ♀, Portola, Sept. 5, 1917. (Cornell U. Exped.) 1 ♂, Samoa Beach and Dunes, Humboldt Co., June 18, 1907.

Oregon, 1 ♂, Hermiston, July 9, 1922.

Washington, 1 ♀, Lake Chelan, Stehekin, July 30, 1919 (A. L. Melander): 2 ♂, Lake Paha, July 20, 1920; 1 ♂, Ritzville, Sept. 9, 1920; 1 ♀, Coulee City, Sept. 3, 1920 (R. C. Shannon).

Idaho, 3 ♂, Soldier Creek, Priest Lake, Aug. 22, 1919; 1 ♂, Potlatch, Sept. 20, 1919 (A. L. Melander).

Alberta, 1 ♀, Banff, Aug. 5, 1925 (Owen Bryant).

Illinois, 1 ♀, Muncie, May 29, 1919.

New York, 1 ♂, McLean, Sept. 11, 1920; 1 ♂, Ithaca, Aug. 19, 1920; 1 ♂, Ringwood, Ithaca, June 26, 1920; 1 ♂, Michigan Swamp, Tompkins Co., July 12, 1921.

Johnson (17) has considered *Leucomelina garrula* Giglio-Tos as a synonym of *narona*. I have only been able to see a female specimen of *garrula* that has been authentically named, and prefer to leave the matter open until more material is available.

The species is widely distributed throughout the North American continent, specimens having been seen from Mexico, Florida, and Texas; California, Washington, and Oregon; Illinois; New Jersey and New York; the New England States; and Canada. There is a considerable degree of variation according to the localities, but an examination of the genitalic appendages has failed to indicate any significant differences that might justify the separation of the specimens into more than one species.

In a series of specimens from the Okefenokee Swamps of Georgia, the vein *M*. 1 + 2 is very slightly curved at apex and the calyptræ are intensively infuscated. In occasional specimens there are only three pairs of postsutural dorsocentral bristles instead of the normal four pairs.

Limnophora (*Limnophora*) *discreta* Stein

Limnophora discreta Stein, Berl. Ent. Zeitschr., 1898 (1897) XLII p. 204.—Aldrich, Misc. Coll. Smithsn. Inst., 1905 XLVI No. 1444 p. 547.—Smith, Ann. Rept. N. J. State Mus. 1909,

1910 p. 791.—Johnson, Bull. Amer. Mus. Nat. Hist., 1913 XXXII Art. 3 p. 76.—Malloch, Trans. Amer. Ent. Soc., 1918 XLIV No. 782 p. 275.—Stein, Arch. f. Naturgesch., 1919 (1917) Abt. A Heft 1 p. 134.—Malloch, Canad. Ent., 1921 LIII p. 64.—Marchand, Bull. Brooklyn Ent. Soc., 1923 XVIII p. 58.—Johnson, Occ. Pap. Boston Soc. Nat. Hist., No. VII 1925 p. 228.—Huckett, Mem. 101 N. Y. (Cornell) Agric. Exp. Station, 1928 (1926) p. 834.

Limnophora incrassata Malloch, Proc. Cal. Acad. Sci., 1919 ser. 4 IX No. II p. 299.

Leucomelina discreta Cole and Lovett, Proc. Cal. Acad. Sci., 1921 ser. 4 XI No. 15 p. 311.

RECORDS :—

New Mexico, 1 ♂, Socorro—1916 (S. W. Williston).

Nevada, 1 ♀, Ormsby Co., July 6—(Baker).

California, 1 ♂, Los Angeles Co., April; 1 ♂, Fallen Leaf, 6500 ft., July 17, 1917 (J. M. Aldrich).

Oregon, 1 ♀, Hood River, June 8, 1917 (F. R. Cole): 1 ♂, Eagle Creek, Aug. 2, 1921.

Washington, 1 ♀, Entiat, July 26, 1919; 1 ♀, Central Ferry, Sept. 3, 1921; 1 ♀, Paradise Park, Mt. Rainier, Aug., 1921; 3 ♂, Mt. Adams, July 24, 1921; 1 ♂, Lake Stephens, Everett, Aug. 3, 1917; 1 ♂, 1 ♀, Hoods Canal, Potlatch, July 28, 1917; 1 ♂, Van Trump, Mt. Rainier, July 21, 1922; 3 ♂, Shuiskin, Mt. Rainier, July 28, 1922; 1 ♂, Mazama Rdg., Mt. Rainier, July 23, 1922; 1 ♂, Lilliwaup, July 23, 1917. (A. L. Melander): 1 ♀, Lake Paha, Sept. 20, 1920. (R. C. Shannon).

Idaho, 3 ♀, Moscow, Aug. 6, 1912; 1 ♂, — (J. M. Aldrich).

1 ♀, Moscow, June 8, 1921; 2 ♀, Priest Lake, Cavanaugh B., Aug. 18, 19—; 1 ♂, Lake Waha, June 9, 1918 (A. L. Melander): 1 ♂, Mt. Moscow, July, 1922 (J. M. Aldrich).

Alberta, 1 ♀, Banff, July 4, 1925 (Owen Bryant): 1 ♀, Nordegg, July 5, 1921 (J. McDunnough): 1 ♂, Great Slave Lake, N. W. T., Aug., 1925 (J. Russell).

Wyoming, 1 ♀, U. Geyser Basin, Yellowstone Park, Aug. 7, 1918 (A. L. Melander).

Montana, 1 ♀, Summit Sta., 5200 ft. July 25 —.

Utah, 1 ♂, Emigrant Canyon, Wasatch Mts., 7000 ft. July 8, 1911.

Colorado, 1 ♀, Tennessee Pass, July 24, 1917; 1 ♂, 10,240 ft. July 11 — (J. M. Aldrich).

New York, 1 ♂, 1 ♀, Ringwood, Ithaca, June 26, 1920; 1 ♂, July 13, 1920; 1 ♀, June 14, 1920: 1 ♂, Fall Creek, Ithaca, April 26, 1921; 1 ♂, Ithaca, May 23, 1920: 1 ♂, July 1-7 — (J. M. Aldrich). 1 ♂, 3 ♀, Buttermilk, Ithaca, July 10, 1920; 1 ♀, July 18, 1920; 4 ♂, 1 ♀, Coy Glen, Ithaca, June 12, 1920; 1 ♀, Sept. 10, 1920: 1 ♂, Taghanic, Ithaca, July 17, 1920: 1 ♀, Montezuma Marsh, Cayuga Co., July 1, 1920: 1 ♂, Riverhead, L. I., April 21, 1926; 1 ♂, Aug. 20, 1927: 1 ♂, Wantagh, L. I., June 12, 1921: 1 ♂, Hempstead, L. I., April 24, 1921; 1 ♂, June 3, 1921; 1 ♀, June 5, 1921; 1 ♀, April 10, 1921: 1 ♂, Mattituck, L. I., May 20, 1921: 1 ♀, Albany, June 24, 1920: 1 ♀, Shelving Rock Br., Lake George, Sept. 2, 1920 (M. D. Leonard).

New Hampshire, 2 ♀, Franconia, — (Mrs. Slosson).

This species is almost cœxtensive with *narona* in its distribution, having been recorded from Florida and New Mexico; California, Oregon, and Washington; the Rocky Mountain States of Idaho, Montana, Wyoming, and Colorado, and the Canadian Province of Alberta; Illinois; New Jersey, New York, and New England.

I have a large series of specimens before me among which there are occasional specimens with three pairs of postsutural dorsocentral bristles instead of the normal four pairs. In isolated cases there is a slight indication that the vein M. 1+2 is curved at apex. In the males the distance separating the eyes across the frons varies considerably in extent. In none of the female specimens has the mid tibia a median anterodorsal bristle, though in a few specimens the fore tibia possesses a median posterior bristle.

Limnophora (*Limnophora*) *groenlandica* Malloch

Limnophora groenlandica Malloch, Trans. Amer. Ent. Soc., 1920 XLVI No. 802 p. 147.—Malloch, Canad. Ent., 1921 LIII p. 64.

The species is recorded from Greenland, being represented only by the female sex. As indicated by Malloch's description and key, the female very closely resembles that of *discreta*.

Subgenus **Pseudolimnophora** Strobl

Pseudolimnophora Strobl, Verh. zool.-bot. Ges. Wien, 1894 (1893) XLIII p. 272.—Coquillett, Journ. N. Y. Ent. Soc., 1901 IX p. 140.—Collin, Ent. Month. Mag., 1921 ser. 3 VII p. 97.—Karl, Tierwelt Deutschlands, T. XIII 1928 p. 94.

Strobilia Pokorny, Verh. zool.-bot. Ges. Wien, 1894 (1893) XLIII p. 541.

Cænusia Meade, Descr. List Brit. Anth., 1897 II p. 74.

Limnophora Schnabl, Hor. Soc. Ent. Ross., 1889 XXIII p. 335.—Schnabl, Hor. Soc. Ent. Ross., 1890 (1889-1890) XXIV pp. 496. 500.—Pandellé, Revue ent. France, 1899 XVIII p. 131.—Schnabl, Wien Ent. Zeitg., 1902 XXI Heft 6 p. 133.—Stein, Katal. Paläark. Dipt., 1907 III p. 669.—Coquillett, Proc. U. S. Nat. Mus., 1910 XXXVII No. 1719 p. 596.—Schnabl and Dziedzicki, Abh. d. Kaiserl. Leop.-Carol. Deutsch. Akad. d. Naturforsch., 1911 XCV Nr. 2 p. 152.—Stein, Arch. f. Naturgesch., 1914 (1913) Abt. A Heft 8 pp. 27. 28.—Stein, Arch. f. Naturgesch., 1916 (1915) Abt. A Heft 10 pp. 83. 111.—Ringdahl, Ent. Tidskr., 1918 XXXIX Heft 2 p. 160.—Stein, Arch. f. Naturgesch., 1920 (1918) Abt. A Heft 9 pp. 46-47.—Séguy, Faune de France, Part VI 1923 p. 199.

The genus *Pseudolimnophora* was erected by Strobl (61) in 1894 for the reception of six nominal species. Later in the same year Pokorny (38) described the genus *Strobilia*, an arbitrary change of name for *Pseudolimnophora*. Pokorny included in this genus the original species listed by Strobl, including *triangula* Fallen and *Limnospila albifrons* Zetterstedt (= *obscuripes* Rondani) of North American occurrence. In 1901 Coquillett (11) designated *Musca triangula* Fallen, the first species of the original series, as the type of *Pseudolimnophora*. In 1921 Collin (5) maintained the group as a subgenus of *Limnophora sens.-lat.*, indicating its relationship to *Limnophora sens.-str.* through the possession of a few setulæ at base of vein *R*. 4+5 and the presence of a series of hairs on lateral margins of prosternum.

The species belonging to this group were included in the genus *Cænusia* by earlier European authors, no doubt on account of the widely separated eyes and the strongly developed vertical and ocellar bristles in the male. Later workers transferred the

species *triangula*, *albifrons*, and *nigripes* to the genus *Limnophora sens.-lat.*, chiefly on account of the markings and structure of the abdomen.

Diagnostic characters:—Wing vein *R.* 4 + 5 with a few setulæ at base; prosternum with a series of setulæ along lateral margins; first abdominal sternum with setulæ; hind tibia with apical anterodorsal bristle lacking; eyes in male as widely separated as in female.

***Limnophora* (*Pseudolimnophora*) *nigripes* (Robineau-Desvoidy)**

Limosia nigripes Rob.-Desv., Essai Myod., 1830 p. 541.

Cænusia nigripes Macquart, Hist. Nat. d. Ins., 1835 II p. 349.—Meigen, Syst. Besch., 1838 VII p. 336.—Rondani, Della Soc. Ital. Scienze Naturali, 1866 IX p. 203.—Rondani, Dipt. Ital. Prodr., 1877 VI p. 267.

Limnophora (*Limnophora*) *nigripes* Schnabl, Hor. Soc. Ent. Ross., 1889 XXIII p. 335.—Séguy, Faune de France, Part VI 1923 p. 202.

Limnophora nigripes Stein, Arch. f. Naturgesch., 1914 (1913) Abt. A Heft 8 p. 29.—Stein, Arch. f. Naturgesch., 1916 (1915) Abt. A Heft 10 p. 105.—Ringdahl, Ent. Tidskr., 1918 XXXIX p. 160.—Stein, Arch. f. Naturgesch., 1920 (1918) Abt. A Heft 9 pp. 47. 57.—Ringdahl, Tromsø Museums Årshefter, 1928 (1926) XLIX No. 3 p. 28.

Limnophora (*Pseudolimnophora*) *nigripes* Collin, Ent. Month. Mag., 1921 ser. 3 VII p. 241.—Karl, Tierwelt Deutschlands, Th. XIII 1928 p. 94.

Pseudolimnophora nigripes Collin, Trans. Ent. Soc. London, 1930 LXXVIII Pt. 2 p. 277, pls. 17. 24.

RECORDS:—

Alaska, 3 ♂, 3 ♀, Naknek Lake, Savonoski, June, 1919: 5 ♂, 2 ♀, July, 1919: 5 ♂, 1 ♀, July 27, 1919: 1 ♂, July 28, 1919: 1 ♀, July 31, 1919: 1 ♂, Aug. 1, 1919: 1 ♀, Aug., 1919. (Jas. S. Hine)

British Columbia, 1 ♂, Oliver, April 27, 1923. (C. B. D. Garrett) 1 ♀, Agassiz, June 11, 1926. (H. H. Ross)

Alberta, 1 ♂, Nordegg, July 5, 1921. (J. McDunnough)

Washington, 3 ♂, Oroville, — ; 1 ♂, Kamiac Buttee, —. (A. L. Melander.

Ontario, 1 ♂, Lake Abitibi, Low Bush, June 7, 1925; 2 ♂, Aug. 8, 1925; 1 ♀, Aug. 1, 1925. (N. K. Bigelow). 1 ♀, Ottawa, May 18, 1927. (C. H. Curran). 1 ♀, Ottawa, July 21, 1914. (G. Beaulieu)

I am of the opinion that all the above specimens represent a single species despite a marked degree of variation, notably in the number of postsutural dorsocentral bristles and in the bristling of the mid tibia. Three male specimens from Alaska and one from British Columbia have three pairs of postsutural dorsocentral bristles, and five males and one female specimen from Alaska have four postsutural dorsocentral bristles on one side and three on the other, the so-called second bristle being very weak. The mid tibia possesses one to three posterior bristles, the number frequently varying in a single specimen.

A second species belonging to the group, namely *triangula* Fallen, has been recorded by Lundbeck (22) as occurring in Greenland. This species is distinguished in part from *nigripes* by the presence of three pairs of postsutural dorsocentral bristles, and by having one posterior bristle on mid tibia, characters which I am unable to appraise correctly owing to the variation shown by the above specimens.

Limnophora (*Pseudolimnophora*) *triangula* (Fallen)

Musca triangula Fallen, Dipt. Suec., Muscides, 1825 II p. 74.

Anthomyia triangula Meigen, Syst. Besch., 1826 V p. 148.

Limnophora triangula Macquart, Hist. Nat. d. Ins., 1835 II p. 311.—Stein, Katal. Paläark. Dipt., 1907 III p. 675.—Stein, Arch. f. Naturgesch., 1914 (1913) Abt. A Heft 8 p. 28.—Stein, Arch. f. Naturgesch., 1916 (1915) Abt. A Heft 10 p. 111.—Ringdahl, Ent. Tidskr., 1918 XXXIX p. 160.

Anthomyza triangula Zetterstedt, Ins. Lapp., 1838 p. 685.

Aricia triangula Zetterstedt, Dipt. Scand., 1845 IV p. 1482.

Cænusia triangula Schiner, Fauna Austr., 1862 I p. 664.—Meade, Ent. Month. Mag., 1883 XX p. 105.—Meade, Descr. List Brit. Anth., 1897 II p. 74.—Van Der Wulp, Tijdschr. v. Entom., 1898 XLI p. 107.—Lundbeck, Videns. Medd. Nat. Foren.

Kjöben., 1901 (1900) ser. 6 II p. 289.—Aldrich, Misc. Coll. Smithsn. Inst., 1905 XLVI No. 1444 p. 562.

Limnophora (*Limnophora*) *triangula* Schnabl, Hor. Soc. Ent. Ross., 1889 XXIII p. 335.—Schnabl and Dziedzicki, Abh. d. Kaiserl. Leop.-Carol. Deutsch, Akad. d. Naturforsch., 1911 XCV Nr. 2 p. 152.—Séguy, Faune de France, 1923 Part VI p. 205.

Pseudolimnophora triangula Strobl, Verh. zool.-bot. Ges. Wien, 1894 (1893) XLIII p. 272.—Coquillett, Journ. N. Y. Ent. Soc., 1901 IX p. 140.—Collin, Trans. Ent. Soc. London, 1930 LXXVIII Pt. 2 p. 277, pls. 17-24.

Strobilia triangula Pokorný, Verh. zool.-bot. Ges. Wien, 1894 (1893) XLIII p. 541.

Aricia (*Limnophora*) *triangula* Pandellé, Revue ent. France, 1899 XVIII p. 131.

Limnophora (*Pseudolimnophora*) *triangula* Collin, Ent. Month. Mag., 1921 ser. 3 VII p. 242.—Karl, Tierwelt Deutschlands, Th. XIII 1928 p. 94.

This species has been recorded by Lundbeck (22) from Greenland. According to many European authors the species may be separated from *nigripes* by the possession of only three pairs of postsutural dorsocentral bristles. Among the specimens recorded as *nigripes* there are a few with three pairs of postsutural dorsocentral bristles, but I am of the opinion that this number represents a variation within the species rather than a specific character.

There is apparently a considerable degree of confusion in the literature concerning the identity of the species. Stein (56) in 1907 listed *nigripes* Robineau-Desvoidy as a synonym of *triangula* Fallen, and *Cænusia triangula* of Rondani as a synonym of *pacifica* Schiner not Meigen (= *pollinifrons* Stein). Strobl (61) in 1894 listed *Cænusia nigripes* Macquart not Robineau-Desvoidy as a synonym of *triangula* Fallen. In 1916 Stein (58) recognized *nigripes* Robineau-Desvoidy and *triangula* Fallen as distinct species.

Subgenus **Sphenomyia** Aldrich

Sphenomyia Aldrich, Proc. Ent. Soc. Wash., 1919 XXI No. 5 p. 108.—Seamans, Canad. Ent., 1926 LVIII p. 175.

The genus *Sphenomyia* was described by Aldrich (2) in 1919 for the reception of one species, *kincaidi* new. In 1926 Seamans (50) added another species to the genus, *banffi* new. In general characteristics this group is much more closely allied to those lacking the setulæ at base of vein *R.* 4 + 5 than to those possessing such.

Diagnostic characters:—Wing vein *R.* 4 + 5 with setulæ towards base; prosternum with no series of setulæ along lateral margins; hind tibia with an apical anterodorsal bristle; frontal vitta with a black polished triangular area, small and confined to the vicinity of ocellar triangle in male, large and extending to base of antennæ in female; sternopleural bristles arranged 1:1.

KEY TO FEMALES

1. Halteres yellowish, at most tinged with purple; ovipositor very much flattened laterally *biquadrata* Walker
- Halteres black; ovipositor not markedly flattened laterally. *kincaidi* Aldrich

Limnophora (*Sphenomyia*) *biquadrata* (Walker)

Eriphia biquadrata Walker, List Dipt. Brit. Mus., 1849 (1848) IV p. 963.—Osten Sacken, Misc. Coll. Smithsn. Inst., 1878 III p. 167.—Aldrich, Misc. Coll. Smithsn. Inst., 1905 XLVI No. 1444 p. 535.

Limnophora biquadrata Stein, Zeitschr. f. Hymen, u. Dipt., 1901 I Heft 4 p. 189.—Aldrich, Misc. Coll. Smithsn. Inst., 1905 XLVI No. 1444 p. 546.—Stein, Arch. f. Naturgesch., 1919 (1917) Abt. A Heft 1 p. 134.

Sphenomyia banffi Seamans, Canad. Ent., 1926 LVIII p. 175.

Male: Head with parafrontals and parafacials silvery pruinulent, cheeks less highly so; frontal vitta black with trace of whitish pruinescence; antennæ and palpi black, third antennal segment with trace of pruinescence; frontal triangle and proboscis polished. Thorax entirely black, shining, with trace of brownish pruinescence. Abdomen with terga 1 + 2 largely blackened, dorsum of terga 3, 4, and 5 silvery pruinulent, terga 3 only with a pair of black subquadrate marks. Ventral surface of abdomen blackish subshining. Legs black. Wings hyaline; calyptre whitish with yellow margins; halteres yellowish brown, tinged with purple.

Eyes large, with a few hairs, separated by a distance equal to that between posterior ocelli; frontal vitta gradually narrowed caudad to lineal dimensions; parafrontal bristles continued in series caudad to level of frontal triangle; parafacials, at base of antennæ, and cheeks narrower than breadth of third antennal segment; bristles and setulæ confined to ventral border of cheeks; arista minutely pubescent. Thorax with numerous fine setulæ; acrosticals setulose; postsutural dorsocentral bristles four pairs; scutellum with a few setulose hairs on lateral declivities; mesopleural series of bristles with an intermediate predorsal bristle; sternopleural bristles, 1:1.

Abdomen ovate, depressed; tergum 3 with a pair of narrowly separated subquadrate marks, restricted to mesal third of tergum; terga 4 and 5 unmarked; sternum 5 with a few fine setulæ, and with 2 or 3 fine bristles towards apex or processes.

Fore tibia with no posterior median bristle; mid femur with a series of weak bristles on proximal half of anteroventral surface, and a series of longish bristles on proximal half of posteroventral surface; mid tibia with 2 posterior bristles; hind femur with 3 or 4 bristles on distal half of anteroventral surface, with no bristles on proximal half of posteroventral surface; hind tibia with 1 or 2 anteroventral, 2 or 3 anterodorsal, and 1 or 2 weaker posterior bristles.

Wings with costal thorns small; veins *R.* 4+5 and *M.* 1+2 gradually divergent toward wing margin. Length, 5.25 mm.

RECORDS:—

British Columbia, 1 ♂, Oliver, April 27, 1923; 1 ♂, May 28, 1923. (C. B. D. Garrett)

Alberta, 1 ♀, Banff, June 16, 1922. (C. B. D. Garrett)

Wyoming, 1 ♀, Canyon Camp, Yellowstone Park, Aug. 12, 1918. (A. L. Melander)

Manitoba, 1 ♂, 1 ♀, Victoria Beach, Aug. 8, 1926. (G. S. Brooks) 1 ♀, Stony Mountain, Aug. 9, 1923. (J. B. Wallis)

Ontario, 1 ♂, Macdiarmid, Lake Nipigon, June 11, 1922; 1 ♀, Lake Abitibi, Low Bush, June 10, 1925. (N. K. Bigelow)

1 ♂, Ottawa —.

I feel confident that the above males and females are conspecific, despite the fact that they exhibit a marked case of

sexual dimorphism. The male of *biquadrata* has a silvery pruinulent abdomen, whereas in the female the abdomen is entirely black and highly shining. A male specimen was sent to Mr. J. E. Collin for comparison with Walker's type in the British Museum, who reported that, in his opinion, the specimens were identical.

Limnophora (Sphenomyia) kincaidi (Aldrich)

Sphenomyia kincaidi Aldrich, Proc. Entom. Soc. Wash., 1919 XXI No. 5 p. 108.

RECORDS:—

Alaska, 1 ♀, Bering Sea, July, 1913. (F. Johansen)

The females of *kincaidi* may be readily distinguished from those of *biquadrata* by having the halteres blackened and not yellowish. In both species the ovipositor is armed with coarse spinules on anal plates, the scutellum has a number of setulose hairs on lateral declivities, and the mesopleural series of bristles possesses an intermediate predorsal bristle.

Subgenus **Bucephalomyia** Malloch

Bucephalomyia Malloch, Trans. Amer. Ent. Soc., 1918 XLIV No. 782 p. 273.

The genus *Bucephalomyia* was proposed by Malloch (26) in 1918 for the reception of one species, *Tetramerinx femorata* Malloch. The genus is allied to *Pseudolimnophora* in that the vein *R*. 4+5 has a few setulæ at base, the abdomen has broad subtriangular marks, the legs are weakly and sparsely bristled, and the eyes in the male are broadly separated. However in *Pseudolimnophora* the prosternum has a series of setulose hairs along lateral margins, whereas in *Bucephalomyia* the prosternum is bare.

Diagnostic characters:—Vein *R*. 4+5 of wing with setulæ toward base; prosternum with no series of setulose hairs along lateral margins; first abdominal sternum bare; frontal vitta pollinose, with no polished frontal triangle; hind tibia with no apical anterodorsal bristle; sternopleural bristles arranged 1 : 2.

Limnophora (Bucephalomyia) femorata (Malloch)

Tetramerinx femorata Malloch, Proc. U. S. Nat. Mus., 1913 XLV No. 2004 p. 603.—Malloch, Canad. Ent., 1917 XLIX p. 226.

Bucephalomyia femorata Malloch, Trans. Amer. Ent. Soc., 1918 XLIV No. 782 p. 273.

Limnophora femorata Stein, Arch. f. Naturgesch., 1919 (1917) Abt. A Heft 1 p. 135.

This species has been recorded from Los Angeles, California, and from Alamogordo, New Mexico, and constitutes the sole representative of the subgenus. The species, except for the characteristic triangular markings on the abdomen, is strikingly different from those of other subgenera belonging to *Limnophora sens. lat.*, resembling in many respects those species found in such associated genera as *Tetramerinx*, *Phyllogaster*, or *Pseudocænosis*.

The head in male and female is dichoptic, with silvery pruinescence, the antennæ and arista are elongated, tachinidlike, the ocellar and vertical bristles in both sexes are robust, the oral margin is not produced; the legs are weakly and sparsely bristled, and the hind tibia lacks the apical anterodorsal bristle. Further, in the male the hind coxæ have each two stubby spines at apex (ventrad), whilst in the female the mid coxæ have each a stout recurved spine; in the male the hind femur has a fasciculus of short spines at base of ventral surface which is absent in the female; the anal plates of ovipositor possess setulose hairs only.

Subgenus *Lispoides* Malloch

Lispoides Malloch, Trans. Amer. Ent. Soc., 1920 XLVI No. 802 p. 146.—Malloch, Canad. Ent., 1921 LIII p. 61.

The genus *Lispoides* was erected by Malloch (27) in 1920 for the reception of a single species, *Limnophora æquifrons* Stein. The subgenus differs essentially from its allies in that the parafacial setulæ are continued ventrad onto the dorsal region of parafacials.

Diagnostic characters:—Wing vein *R*. 4+5 with no setulæ toward base; prosternum with no series of setulæ on lateral margins; first abdominal sternum hairy; dorsal half of parafacials clothed with a few setulose hairs.

Limnophora (*Lispoides*) *æquifrons* Stein

Limnophora æquifrons Stein, Berl. Ent. Zeitschr., 1898 (1897) XLII Heft 3 and 4 p. 205.—Stein, Ann. Mus. Nat. Hungarici,

1904 II p. 466.—Aldrich, Misc. Coll. Smiths. Inst., 1905 XLVI No. 1444 p. 546.—Smith, Ann. Report N. J. State Museum, 1909, 1910 p. 790.—Malloch, Trans. Amer. Ent. Soc., 1918 XLIV No. 782 p. 275.—Stein, Arch. f. Naturgesch., 1919 (1917) Abt. A Heft 1 p. 133.—Stein, Arch. f. Naturgesch., 1920 (1918) Abt. A Heft 9 p. 56.—Cole and Lovett, Proc. Cal. Acad. Sci., 1921 XI No. 15 p. 311.

Lispoides æquifrons Malloch, Trans. Amer. Ent. Soc., 1920 XLVI No. 802 p. 147.—Johnson, Occ. Papers Boston Soc. Nat. Hist., No. VII, 1925 p. 228.—Huckett, Mem. 101, N. Y. (Cornell) Agric. Exp. Station, 1928 (1926) p. 834.

Lispoides æqualis Malloch, Canad. Ent., 1921 LIII p. 61.—Cridle, 58th Ann. Rept. Ent. Soc. Ont., 1927, 1928 p. 100.

RECORDS:—

Alberta, 1 ♂, High River, Sept. 27, 1927. (O. Bryant)

Washington, 1 ♂, 2 ♀, Coulee City, Sept. 3, 1920; 1 ♂, Stratford, Sept. 4, 1920. (R. C. Shannon) 1 ♀, Wawawai, May 28, 1922; 1 ♀, Entiat, July 26, 1919; 1 ♀, Spokane, Aug. 8, 1919; 1 ♀, Lilliwaup, Aug. 12, 1921. (A. L. Melander)

Oregon, 1 ♀, Hood Rapids, Mt. Hood, July 29, 1921. (A. L. Melander)

California, 1 ♂, San Diego, June 28, 1917 (J. M. Aldrich)

Idaho, 2 ♂, Lewiston, June 1, 1919; 1 ♂, Moscow Mt., May 14, 1921. (A. L. Melander)

Colorado, 1 ♀, Tenn. Pass, July 23, 1917. (J. M. Aldrich)

Arizona, 1 ♂, Pinnaleno Mts., Ft. Grant, July 18, 1917. (R. C. Shannon)

Indiana, 1 ♂, Lafayette, Sept. 23, 1917; 1 ♀, Nov. 5, 1913. (J. M. Aldrich)

New York, 1 ♀, Ithaca, June. (R. C. Shannon); 1 ♀, Coy Glen, Ithaca, June 12, 1920. (M. D. Leonard); 2 ♂, Coy Glen, Ithaca, Aug. 1, 1920; 3 ♂, 2 ♀, Sept. 19, 1920; 2 ♂, 1 ♀, Butternut Creek, Ithaca, Sept. 25, 1920; 2 ♀, Buttermilk, Ithaca, July 10, 1920; 1 ♀, Ithaca, 19—; 2 ♂, 1 ♀, Aurora, May 30, 1920; 1 ♀, Harmon, July 5, 1926; 1 ♂, 1 ♀, Valley Stream, Long Island, April 27, 1921; 1 ♂, Cold Spring Harbor, Long Island, July 26, 1921.

Quebec, 1 ♀, St. Chrysostome, June 28, 1917. (G. S. Walley)

The species is undoubtedly present in nearly all parts of North America. It is commonly to be found on the rocks of rivers and streams. The head of the male and female are very similar in structure and vestiture, the eyes being separated by a distance slightly less than that between the oral vibrissæ. In addition, the species may be readily separated from those which possess widely separated eyes in the male by the presence of setulose hairs on the dorsal half of parafacials.

Subgenus **Gymnodia** Robineau-Desvoidy

Gymnodia Robineau-Desvoidy, Hist. Natur. d. Dipt., 1863 II p. 635.—Pandellé, Revue ent. France, 1898 XVII pp. 22, 45.—Stein, Katalog Paläark. Dipt., 1907 III p. 747.—Collin, Ent. Month. Mag., 1921 3rd ser. VII pp. 96, 99.—Séguy, Faune de France, Part VI, 1923 pp. 196, 217.—Karl, Die Tierwelt Deutschlands, T. 13, 1928 pp. 93, 104.—Malloch, Entom. Mitteil., 1928 Band XVII Nr. 4 pp. 290, 296.

Brontaea Kowarz, Verh. zool.-bot. Ges. Wien, 1873 XXIII p. 461. Schnabl and Dziedzicki, Abh. d. Kaiserl. Leop.-Carol. Deutsch. Akad. d. Naturforsch., 1911 Band XCV Nr. 2 p. 149.

Spilogaster in part, Meade, Ent. Month. Mag., 1881 XVIII p. 102.—Meade, Deser. List Brit. Anth., 1897 I p. 23.

Limnophora in part, Williston, Trans. Ent. Soc. Lond., 1896 Part III p. 369.—Pandellé, Revue ent. France, 1899 XVIII, p. 130.—Stein, Katalog Paläark. Dipt., 1907 III pp. 669, 673.—Coquillett, Proc. U. S. Nat. Mus., 1910 XXXVII No. 1719 p. 548.—Stein, Arch. f. Naturgesch., 1914 (1913) Abt. A Heft 8 pp. 28, 29.—Stein, Arch. f. Naturgesch., 1916 (1915) Abt. A Heft 10 pp. 83, 109.—Ringdahl, Ent. Tidskr., 1918 XXXIX Heft 2 p. 159.

Eulimnophora Malloch, Trans. Amer. Ent. Soc., 1920 XLVI No. 802 p. 145.—Malloch, Canad. Ent., 1921 LIII p. 12.—Malloch, Ann. Mag. Nat. Hist., ser 9 1921 VII p. 165.

In 1863 Robineau-Desvoidy described the genus *Gymnodia* for the reception of the single species *pratensis*, new, which has been regarded by subsequent authors as the type of the genus. It was early accepted that *Gymnodia pratensis* was a synonym of *Anthomyia polystigma* Meigen, a species listed by Macquart (23)

in 1835 as belonging to the genus *Limnophora sens.-lat.* On account of the distal curvature of the wing vein *M.* 1+2 in the type, the genus *Gymnodia* was associated by both Robineau-Desvoidy and Pandellé (41) (37) with such muscoid genera as *Graphomyia*, *Muscina*, and *Stomoxys*. Stein (56) in his catalog of palaearctic diptera recorded the genus as interpreted by Pandellé among the "*genera dubia*," although earlier in the same work he had listed Robineau-Desvoidy's genus among the synonyms of *Limnophora*.

In later years, Collin (5), followed by Séguéy (51) and Karl (19), has redefined the genus, maintaining its association with closely allied groups as subgenera of the genus *Limnophora sens.-lat.*

In 1873 Kowarz (20) erected the genus *Brontæa* with *polystigma* Meigen as type. If the synonymy of *pratensis* with *polystigma* be accepted, then *Brontæa* becomes an absolute synonym of *Gymnodia*.

In 1881 Meade (34) included the species *polystigma* together with other British species of *Limnophora sens.-lat.* in the genus *Spilogaster*.

In 1911 Schnabl and Dziedziński (49) maintained the identity of *Brontæa* as a valid subgenus of *Limnophora*, whilst Stein and other European authors continued to regard the genus of doubtful rank, merging its identity with that of *Limnophora*.

In 1920 Malloch (27) described the North American genus *Eulimnophora*, designating *Limnophora arcuata* Stein as the type. There are apparently no satisfactory reasons for maintaining the separate identity of this genus and *Gymnodia*, the generic characters being almost identical.

There are three species belonging to this segregate that have been recognized as occurring in North America; two of them are known to inhabit filth, resembling the common house fly in this respect. According to Malloch (30) the group is better represented in Africa.

Diagnostic characters:—Wing vein *R.* 4+5 with no setulæ at base; prosternum with no series of hairs along lateral margins; parafrontal setulæ not descending onto parafacials to a level below that of base of third antennal segment; eyes ab-

normally large and expansive, restricting the parafrontals and parafacials to lineal dimensions when viewed in profile; in North American species the anterior intraalar bristle is weakly developed, sometimes absent, never longer than caudal pair of acrostical bristles; and the abdominal marks are arcuate in outline; the hind tibiae have the apical anterodorsal bristle absent.

KEY TO SPECIES

1. Palpi and tibiae largely yellowish; thorax with three or more strongly marked vittae *debilis* Williston
- Palpi and tibiae largely black; thorax with vittae more or less suffused and not sharply defined 2
2. Hind femur with a series of bristles on entire length of anteroventral surface those on proximal half short but distinctive; fifth sternum in male with a dense series of longish fine bristles around the border of caudal emargination *cilifera* Malloch
- Hind femur with anteroventral bristles confined to distal half of surface the proximal half with an irregular series of setulae; fifth sternum in male with only one or two longish setulae adjacent caudal emargination *arcuata* Stein

***Limnophora* (*Gymnodia*) *debilis* Williston**

Limnophora debilis Williston, Trans. Ent. Soc. London, 1896 III p. 369.—Aldrich, Misc. Coll. Smithsn. Inst., 1905 XLVI No. 1444 p. 547.

Eulimnophora dorsovittata Malloch, Trans. Amer. Ent. Soc., 1920 XLVI No. 802 p. 146.—Malloch, Canad. Ent., 1921 LIII p. 12.—Frison, Bull. Ill. Nat. Hist. Surv., 1927 XVI Art. 4 p. 199.

RECORDS:—

- 1 ♀, Dallas, Texas, Sept. 17, 1907; 1 ♂, Sept. 18, 1907; 2 ♂, Sept. 19, 1907, bred from cow manure (F. C. Pratt). 1 ♀, Biscayne Bay, Florida (A. T. Slosson).

The species is evidently well represented in the countries adjoining the Gulf of Mexico, being recorded from Jamaica, Porto Rico, and St. Vincent, in addition to the above North American records.

I can find no difference that would justify the separation of *dorsovittata* and *debilis* as distinct species. In the above series there is a considerable degree of variation in the color of the abdomen from grayish to entirely yellow depending, evidently, on

the developmental condition of the adults when captured. In the more teneral specimens the color has a tendency to yellowish.

Limnophora (Gymnodia) arcuata Stein

Limnophora arcuata Stein, Berl. Ent. Zeitschr., 1898 (1897) XLII Heft 3 and 4 p. 201.—Coquillett, Proc. U. S. Nat. Mus., 1900 XXII No. 1198 p. 256.—Howard, Proc. Wash. Acad. Sci., 1900 II p. 582.—Stein, Ann. Mus. Nat. Hungarici, 1904 II p. 469.—Aldrich, Misc. Coll. Smithsn. Inst., 1905 XLVI No. 1444 p. 546.—Smith, Ann. Rept. N. J. State Museum 1909, 1910 p. 791.—Stein, Arch. f. Naturgesch., 1911 Abt. A Heft I p. 135.—Johnson, Bull. Amer. Mus. Nat. Hist., 1913 XXXII Art. 3 p. 76.—Stein, Arch. f. Naturgesch., 1919 (1917) Abt. A Heft 1 p. 133.—Stein, Arch. f. Naturgesch., 1920 (1918) Abt. A Heft 9 p. 48, 56.

Eulimnophora arcuata Malloch, Trans. Amer. Ent. Soc., 1920 XLVI No. 802 p. 145.—Malloch, Canad. Ent., 1921 LIII p. 12.

Spilogona (Gymnodia) arcuata Hockett, Mem. 101 N. Y. (Cornell) Agric. Exp. Station, 1928 (1926) p. 834.

RECORDS:—

1 ♀, Riverhead, New York, August 7, 1925; 1 ♀, August 8, 1927; 1 ♀, De Witt, Mitchell Co., Ga., July 23, 1912 (M. D. Leonard); 1 ♀, Gainesville, Tex., May 15, 1923 (E. E. Russell).

The species is widely distributed throughout North America. Howard (16) includes the species among those flies that are commonly found associated with filth and manure, and hence capable of contaminating human food by their presence.

Limnophora (Gymnodia) cilifera (Malloch)

Eulimnophora cilifera Malloch, Trans. Amer. Ent. Soc., 1920 XLVI No. 802 p. 145.—Malloch, Canad. Ent., 1921 LIII p. 12.—Frison, Bull. Ill. Nat. Hist. Surv., 1927 XVI Art. 4 p. 198.

RECORDS:—

1 ♂, Atherton, Missouri, Oct.; 1 ♂, Aug. —; 5 ♂, Columbus, Ohio, April 10 (J. S. Hine).

The species is smaller than either *debilis* or *arcuata*, rarely exceeding four millimeters in length. The females of *cilifera* and

arcuata are not readily distinguished structurally. In the former species the hind femur has a uniform series of short bristly hairs on proximal half of anteroventral surface, which is lacking in *arcuata*.

Subgenus **Spilogona** Schnabl and Dziedzicki

Spilogona Schnabl and Dziedzicki, Abh. d. Kaiserl. Leop.-Carol. Deutsch. Akad. d. Naturforsch., 1911 XCV Nr. 2 pp. 141, 152.—Collin, Ent. Month. Mag., 1921 ser. 3 VII pp. 97, 98, 162.—Séguy, Faune de France, 1923 Pt. VI pp. 196, 205.—Malloch, Psyche, 1924 XXXI No. 5 p. 200.—Karl, Tierwelt Deutschlands, 1928 Th. XIII p. 97.—Collin, Trans. Ent. Soc. London, 1930 LXXVIII Pt. 2 p. 257.

Paralimnophora Malloch, Proc. U. S. Nat. Mus., 1913 XLV No. 2004 p. 603.—Stein, Arch. f. Naturgesch., 1919 (1917) Abt. A Heft 1 pp. 134, 141.

Limnophora in part, Stein, Arch. f. Naturgesch., 1911 Abt. A Heft 1 pp. 111, 137.—Stein, Arch. f. Naturgesch., 1914 (1913) Abt. A Heft 10 p. 27.—Stein, Arch. f. Naturgesch., 1916 (1915) Abt. A Heft 10 p. 83.—Johannsen, Trans. Amer. Ent. Soc., 1916 XLII No. 756 p. 391.—Ringdahl, Ent. Tidskr., 1918 XXXIX p. 158.—Stein, Arch. f. Naturgesch., 1919 (1917) Abt. A Heft 1 p. 133.—Stein, Arch. f. Naturgesch., 1920 (1918) Abt. A Heft 9 p. 46.—Malloch, Trans. Amer. Ent. Soc., 1920 XLVI No. 802 p. 147.

Melanochelia Malloch not Rondani, Canad. Ent., 1921 LIII p. 61.

In 1911 Schnabl and Dziedzicki (49) proposed the subgenus *Spilogona* as one of seven subgenera comprising the genus *Limnophora sens.-lat.* The new group contained nineteen European species, most of which had been recorded previously in such genera as *Aricia*, *Anthomyia*, *Spilogaster*, and *Limnophora* of authors.

The species belonging to *Spilogona* are separated from those of *Limnophora* according to Schnabl and Dziedzicki on the basis of a number of arbitrary characters which are difficult to evaluate, such as the degree of development of the bristles of the legs, the extent of convergence or divergence of veins *R.* 4 + 5 and *M.* 1 + 2, and the structure of the male genitalia. It remained for later workers to exploit the full significance of such conceptions. Mal-

loch (26) in 1918 had found a new combination of characters for splitting the old genus *Limnophora* into at least two parts, but was hesitant in naming them owing to the apparently uncertain status of many of the European segregates. His conception of the group, except for minor differences, approached that of Schnabl and Dziedzicki, although he misnamed the group *Melanochelia Rondani*, a nomenclatorial error corrected by him later (28) (31). Collin (5) in 1921, working independently, introduced the same characters used by Malloch to realign the component parts of *Limnophora sens.-lat.* According to these characters *Spilogona* belongs to the division of *Limnophora sens.-lat.* having no setulæ at base of vein *R.* 4 + 5, and no series of hairs along the lateral margins of prosternum. He, further, designated the fourth species of the original series, namely, *Anthomyia compuncta* Wiedemann, as the type of *Spilogona*. Séguy (51) in 1923 and Karl (19) in 1928 adopted Collin's classification of *Limnophora*, with but minor differences, in compiling a list of the species occurring in France and Germany respectively. Karl incidentally proposed the species *Musca dispar* Fallen as type of *Spilogona*,* a proposal which I am unable to accept on account of Collin's (5) prior designation of *compuncta*.

Stein (58) and Ringdahl (39) evidently recognized that there was some justification for the recognition of certain of the segregates comprising the genus *Limnophora sens.-lat.*, but there is no evidence that they were aware of the full import of such characters as introduced by Malloch and Collin. Hence the segregate *Spilogona* was not recognized by these authors, no doubt partly owing to the inadequacy of the characters cited by Schnabl and Dziedzicki in defining the group.

Malloch (25) in 1913 proposed the genus *Paralimnophora* for the reception of *narina* Walker (= *brunnesquama* Malloch), basing his genus on the widely separated eyes and abnormally stout vertical and ocellar bristles on the head of the male. Stein (59) in 1919 pointed out that *Paralimnophora* was preoccupied in nomenclature, and placed Malloch's species in *Limnophora*. Malloch (28) in his key to *Melanochelia* (Malloch not Rondani)

* See footnote on page 37.

included the same species under the name *velutina* (*brunnesquama* preoc.). I am doubtful whether the genus is entitled to full recognition, and prefer to merge it for the present with *Spilogona*, as already indicated by Malloch himself (28).

The subgenus *Spilogona* contains by far the greatest number of species of any of the groups included in this study. The species are to be found in greatest abundance in the Canadian and subarctic life zones, descending through North America by way of the mountain ranges. In comparison, the species belonging to *Limnophora sens.-str.* and to *Gymnodia* are comparatively numerous in the tropical and subtropical zones whilst those of *Spilogona* are evidently fewer.

In structure *Spilogona* is most closely allied to *Gymnodia*, differing essentially from the latter group in having the frons, parafacials, and cheeks relatively well developed, not constricted to lineal proportions by the abnormal size of the eyes, and, in the North American species, by the markings on the abdomen being subtriangular or trapezoidal in shape, not arcuate.

Diagnostic characters:—Wings with no setulæ at base of vein *R.* 4+5: prosternum with no series of hairs along lateral margins: parafacials at base of antennæ with no setulose hairs descending to a level below that of base of third antennal segment: cheeks well developed, not constricted, usually higher than breadth of parafacials at base of antennæ: abdominal markings, if present, not arcuate in outline, usually trapezoidal, spherical, or subtriangular in outline.

KEY TO SPECIES

Males

1. Postsutural dorsocentral bristles usually four pairs2
- Postsutural dorsocentral bristles usually three pairs54
2. Inner pair of vertical bristles and cephalic pair of ocellar bristles robust, equal in size to first pair of dorsocentral bristles; eyes separated by a distance equal to length of antenna; calyptræ blackish brown*narina* Walker
- Inner pair of vertical bristles and cephalic pair of ocellar bristles slender, shorter than length of first pair of dorsocentral bristles; or, one or other pair of bristles may be as robust, but not both; eyes separated by a distance less than length of antenna, or, if as great, the calyptræ are whitish3
3. Mid tibia with one or more median ventral bristles4

- Mid tibia with no median ventral bristles 9
- 4. Oral margin when viewed in profile, protruded slightly beyond a level with base of antenna 5
- Oral margin, when viewed in profile, not protruded beyond a level with base of antenna 6
- 5. Scutellum with no appressed setulæ on dorsal margin of lateral declivities adjacent the apical bristles; halteres yellowish to brownish; fore tibia with no median posterior bristle; sternopleural bristles, 1: 1. *subrostrata* Stein
- Scutellum with appressed setulæ on dorsal margin of lateral declivities adjacent the apical bristles; halteres black; fore tibia with a median posterior bristle; sternopleural bristles, 1: 2 *hyperborea* Boheman
- 6. Halteres tinged with black; abdomen entirely blackish opaque 7
- Halteres deep yellow; abdomen with more or less grayish pruinescence on terga, subshining 8
- 7. Hind femur with a series of short bristles on basal half of posteroventral surface; parafrontals with a pair of short bristles situated nearly on a level with anterior ocellus; frontal triangle opaque, not highly polished *obsoleta* Malloch
- Hind femur with no bristles on proximal half of posteroventral surface; parafrontals with no pair of weak bristles situated nearly on a level with anterior ocellus; frontal triangle glossy and polished. *melanosoma*, n. sp.
- 8. Hind femur with a proximal series of longish posteroventral bristles; with the anteroventral series of bristles continued to base of femur; notopleural callosity with setulæ *novæ-angliæ* Malloch
- Hind femur with no series of longish bristles on proximal half of posteroventral surface; with the anteroventral series of bristles confined to distal half of femur; notopleural callosity with no setulæ. *sectata*, n. sp.
- 9. Mid femur with a single stout spinelike bristle at base of ventral surface 10
- Mid femur without stout spinelike bristle at base of ventral surface, with or without the usual series of two or more posteroventral bristles 13
- 10. Processes of fifth sternum glossy at apex, highly polished; halteres blackish; mesonotum bluish gray, with trace of brownish median vitta caudad of transverse suture *monacantha* Collin
- Processes of fifth sternum not glossy nor highly polished at apex; halteres yellowish to brownish; mesonotum blackish or cinereous 11
- 11. Parafacials at base of antennæ narrower than breadth of third antennal segment; mesonotum largely blackened, at most with trace of vittæ on presutural area; eyes separated by a distance not greater than that between posterior ocelli; costal thorn small 12
- Parafacials at base of antennæ as broad as breadth of third antennal

- segment; mesonotum grayish pruinosecent, with seal brown infuscation, with 3 to 5 brownish vittæ on postsutural area; eyes separated by a distance at least as great as that between posterior ocelli; costal thorn robust *sospita*, n. sp.
12. Parafrontals contiguous caudad, interrupting the frontal vitta; mid tibia with no anterodorsal bristles; abdominal marks on terga 3 and 4 expansive, extending to ventral surface..... *instans*, n. sp.
- Parafrontals separated caudad by a lineal frontal vitta; mid tibia with 1 or 2 short anterodorsal bristles; abdominal markings on terga 3 and 4 confined to dorsum..... *semiglobosa* Ringdahl
13. Halteres normally blackish 14
- Halteres normally yellowish 34
14. Processes of fifth sternum clothed with a dense mat of fine spinules along inner border *setilamellata*, n. sp.
- Processes of fifth sternum with sparsely set setulæ or fine bristles on inner border 15
15. Oral margin protruded beyond a level with base of antenna..... 16
- Oral margin not protruded beyond a level with base of antenna..... 20
16. Large grayish species, 8 mm.; head buccate (as in *Hammomyia*) with parafacials broader than length of third antennal segment.
- tendipes* Malloch
- Species not exceeding 7 mm. in length; parafacials not as broad as length of third antennal segment; eyes separated by a distance less than length of third antennal segment 17
17. Scutellum with setulose, appressed hairs on dorsal margin of lateral declivities adjacent the apical bristles; mesopleural series of bristles with an intermediate predorsal bristle; abdomen brownish black, shining, with no markings; parafacials at base of antennæ narrower than breadth of third antennal segment..... *almquistii* Holmgren
- Scutellum with no setulose hairs on dorsal margin of lateral declivities adjacent the apical bristles; mesopleural series of bristles with no intermediate predorsal bristle; abdomen with distinct grayish pruinescence and blackish marks; parafacials at base of antennæ as broad as width of third antennal segment..... 18
18. Mesonotum with pale grayish pruinescence, and with five well marked black vittæ, the laterals foreshortened; cerci elongate, produced as a narrow polished, chitinous lamella..... *sanctipauli* Malloch
- Mesonotum largely blackish, with at most a trace of vittæ on presutural area; cerci not elongated, the apex extended as two slender, short styli 18a
- 18a. Scutellum and presutural area of mesonotum sparsely setulose, the presutural acrosticals in two distinct series; mesopleura with pale grayish pruinescence *megastoma* Boheman
- Scutellum and presutural area of mesonotum densely setulose, the presutural acrosticals indistinguishable from the adjacent setulæ; mesopleura entirely blackened 19

19. Eyes with a few hairs; mid tibia with no anterodorsal bristle.
tristiola Zetterstedt
- Eyes bare; mid tibia with 1 or 2 anterodorsal bristles.
extensa Malloch
20. Presutural acrosticals stouter developed than the adjacent setulæ; fore tibia with a strong apical posteroventral bristle; hind tibia with the distal bristle of anterodorsal series stouter developed than the proximal bristle; abdomen with widely separated dorsal markings, between which there are traces of a dorsocentral vitta..... 21
- Presutural acrosticals setulose; fore tibia with a weak apical posteroventral bristle; hind tibia with anterodorsal bristles not noticeably unevenly developed, or the distal bristle of series weaker developed than the proximal bristle; abdomen with markings fused or narrowly separated, and with no apparent dorsocentral vitta..... 22
21. Eyes separated by a distance less than that between posterior ocelli inclusive; parafrontals contiguous cephalad of anterior ocellus; abdomen stoutly developed, short; abdominal markings sharply defined, broadly subtriangular; calyptre white.....*fatima*, n. sp.
- Eyes separated by a distance exceeding that between posterior ocelli; parafrontals noticeably, though narrowly, separated cephalad of anterior ocellus; abdomen conical; abdominal markings ill defined, narrowly subtriangular; calyptre yellowish tinged.
tetrachata Malloch
22. Scutellum with a few setulose hairs on dorsal margin of lateral declivities adjacent apical bristles 23
- Scutellum with no such hairs on dorsal margin of lateral declivities adjacent apical bristles 29
23. Calyptre entirely blackish brown, concolorous with halteres; abdomen entirely blackish, with no markings on terga.....*concolor* Stein
- Calyptre whitish in contrast to color of halteres; abdomen with markings on terga 24
24. Terga 3, 4, and 5 densely whitish pruinose, with a pair of subquadrate marks on tergum 3 only; eyes sparsely haired; halteres fuscous.
leucogaster Zetterstedt
- Terga 3, 4, and 5 with grayish pruinescence, and with markings on tergum 4 as well as on tergum 3 25
25. Hind femur with a series of longish weak bristles on proximal half of posteroventral surface, the anteroventral series of bristles continued to base of femur*obscuripennis* Stein
- Hind femur with no series of bristles on proximal half of posteroventral surface, at most with 1 or 2 isolated bristles; anteroventral series of bristles confined to distal half of femur..... 26
26. Mesopleural series of bristles with one or more weaker intermediate predorsal bristles 27
- Mesopleural series of bristles with no such predorsal bristles..... 28

27. Abdomen broadly ovate, depressed; hind tibia with one robust anterodorsal bristle situated at middle of tibia; basal sclerite of hypopygium with bristles scattered in a transverse series.....*pusilla*, n. sp.
- Abdomen cylindrical or conical, not flattened dorsoventrally; hind tibia with 2 or 3 anterodorsal bristles; basal sclerite of hypopygium restricted, the bristles appearing tufted.....*denudata* Holmgren
28. Abdomen with markings on tergum 3 distinctly though narrowly separated, those on tergum 4 reduced in area, the surface largely densely whitish gray pruinose; halteres black.....*addicta*, n. sp.
- Abdomen with markings on tergum 3 fused across the dorsum, or, obscurely divided at middle, those on tergum 4 well developed, the tergal surface subshining, with dark reflections; halteres brownish.
area Zetterstedt
29. Hind femur with no series of bristles on proximal half of posteroventral surface; sternopleura clothed on ventral surface with a tuft of abnormally stiff bristles*pulvicrura*, n. sp.
- Hind femur with a series of two or more bristles on proximal half of posteroventral surface30
30. Wings densely infuscated, blackened basad; abdominal markings on terga 3 and 4 confined to dorsum, their length longer than their greatest width*carbonella* Zetterstedt
- Wings hyaline or at most with traces of infuscation; abdominal markings on terga 3 and 4 broadly expanding caudad to reach the ventral surface, their length shorter than their greatest width.....31
31. Eyes widely separated, frontal vitta as broad immediately cephalad of anterior ocellus as at base of antennæ; vibrissal area clothed with numerous, short coarse setulæ; ocellar triangle pollinose; hind tibia with apical anterodorsal bristle well developed, equivalent in length to apical anteroventral bristle*nobilis* Stein
- Eyes separated narrowly, frontal vitta not as broad immediately cephalad of anterior ocellus as at base of antennæ; vibrissal angle clothed with numerous fine, longish setulæ; frontal triangle highly polished; hind tibia with apical anterodorsal bristle setulose.....32
32. Eyes with numerous hairs; parafrontal bristles continued in series caudad to a level with anterior ocellus; buccæ with dense, fine, upcurved setulæ; mesonotum largely deep blackish; calyptre and wings clear, hyaline*alberta*, n. sp.
- Eyes bare, or at most with hairs very sparse; parafrontal bristles not continued in series to a level with anterior ocellus; buccæ almost devoid of setulæ, the latter confined in a marginal series ventrad; mesonotum largely grayish33
33. Eyes separated by a distance less than that between posterior ocelli; cheek, ventrad of eye, at greatest height exceeding length of third antennal segment, abruptly constricted throughout the caudal area by the curvature of the occipital margin; thoracic vittæ abruptly termi-

- nated at transverse suture, the presutural area with no brownish vittæ *crepusculenta*, n. sp.
- Eyes separated by a distance greater than that between posterior ocelli; cheek ventrad of eye, at greatest height scarcely as high as length of third antennal segment, the curvature of the occipital margin more obtuse, resulting in a less marked constriction of the caudal area of cheek; thorax with vittæ continued from postsutural to presutural area *comata*, n. sp.
34. Scutellum with two or more setulose, appressed hairs on dorsal margin of declivities adjacent the apical bristles 35
- Scutellum with no such setulose hairs on dorsal margin of declivities adjacent the apical bristles 38
35. Mesopleural series of bristles with one or more weaker intermediate predorsal bristles; markings on tergum 3 large, often fused mesad, extending along the caudal margin of tergum to lateral border of dorsum *area* Zetterstedt
- Mesopleural series of bristles with no intermediate predorsal bristles, the intermission bare; markings of tergum 3 rarely fused mesad 36
36. Hind femur with the distal bristle of anterodorsal series situated at a lower (ventral) plane to those of the series; wings largely infuscated; cross veins clouded; basal sclerite of hypopygium shining. *nigriventris* Zetterstedt
- Hind femur with the distal bristle of anterodorsal series situated in a continuous series with the remainder, not in a decidedly lower (ventral) position; wings largely hyaline, slightly infuscated basad; cross veins clear; basal sclerite of hypopygium grayish pollinose 37
37. Presutural area of thorax with only a median vitta, the postsutural area with three vittæ, the sublaterals not extending cephalad beyond the transverse suture; scutellum entirely infuscated, not concolorous with mesonotum; proboscis with distal section noticeably shortened. *arenosa* Ringdahl
- Presutural area of thorax with three vittæ, median and sublaterals, the latter not foreshortened at transverse suture; scutellum concolorous with mesonotum; proboscis with distal section not abnormal in length *denudata* Holmgren
38. Hind femur with one or more longish bristles on proximal half of posteroventral surface, exceeding in length the apical setæ 39
- Hind femur with a series of normal setulæ on proximal half of posteroventral surface, none of which are longer than the apical setæ 48
39. Processes of fifth sternum of abdomen sharply attenuated at apex; eyes large, when viewed in profile the ventral margin reaching to a level with oral vibrissæ, thereby restricting the cheeks to narrow proportions 40
- Processes of fifth sternum broad and rounded in outline toward apex, not attenuated sharply; cheeks broad, higher than breadth of para-

- facials at base of antennæ; ventral margin of eyes not reaching a level with oral vibrissæ41
40. Abdomen silvery white pruinulent, with two small blackish marks on tergum 3 only*argentiventris* Malloch
- Abdomen grayish pruinulent, with small, paired, deep brownish spots on terga 3 and 4, the marks on tergum 4 more or less obscure.
argentiventris var. *occidentalis*, n. var.
41. Abdomen cinereous gray with two relatively small marks on terga 3 and 4; presutural acrosticals bristlelike but short; vibrissal area clothed with numerous short, stout setulæ.....*cretans*, n. sp.
- Abdomen with tergal markings relatively large or conspicuous; presutural acrosticals setulose; vibrissal area clothed with fine setulæ.....42
42. Scutellum, basal segment of hypopygium and terga 1+2 largely grayish pollinose; wings hyaline43
- Scutellum, basal segment of hypopygium and terga 1+2 largely blackish, subshining; wings infuscated at base44
43. Mid and hind femora with a series of bristles on proximal half of posteroventral surface; eyes widely separated, distance greater than that between posterior ocelli inclusive, parafrontals not contiguous; tibiæ and tarsi usually yellowish*rufitarsis* Stein
- Mid and hind femora with no series of bristles on posteroventral surface, at most with a few longish setulæ at base of femur; eyes separated by a distance less than that between posterior ocelli inclusive, parafrontals contiguous; tibiæ and tarsi usually blackish.
placida, n. sp.
44. Subcosta with a few setulæ on under surface proximad of humeral cross vein; hind tibia with 4 or 5 anteroventral bristles; humeral and notopleural callosities strikingly pale grayish pruinulent.
setinervis, n. sp.
- Subcosta bare on under surface proximad of humeral cross vein; hind tibia with 2 or 3 anteroventral bristles,45
45. Hind femur with bristles on proximal half of posteroventral surface shorter than those on proximal half of posterior surface, not longer than breadth of femur; abdomen narrowly conical, third and fourth sterna longer than broad, clothed with short vestiture.
carbonella Zetterstedt
- Hind femur with bristles on proximal half of posteroventral surface longer than those on proximal half of posterior surface, the longest longer than breadth of femur; abdomen broadly conical, subovoid; third and fourth sterna broader than long, clothed with longish vestiture46
46. Processes of fifth abdominal sternum with a highly polished apical process on inner margin; mid tibia with 1 or 2 well developed antero-dorsal bristles, with no median posteroventral bristle.
compuncta Wiedemann

- Processes of fifth sternum rounded at apex, with no highly polished attenuation on inner margin; mid tibia with anterodorsal bristles at most setulose, frequently absent.....47
- 47. Proboscis polished; fore tibia with no median posterior bristle; first abdominal sternum bare*novæ-angliæ* Malloch
- Proboscis lightly pollinose; fore tibia with a median posterior bristle; first abdominal sternum with a few setulæ.....*alliterata*, n. sp.
- 48. Mesopleural series of bristles with one or more weaker intermediate predorsal bristles49
- Mesopleural series of bristles with no predorsal bristle, the interspace bare50
- 49. Thorax with three distinctive broad bandlike vittæ; eyes with numerous hairs; calyptre intensively yellow; scutellum with a noticeably paler area on discal surface*trilineata*, n. sp.
- Thorax with no distinctive broad vittæ; eyes bare; calyptre slightly tinged; scutellum entirely black*imitatrix* Malloch
- 50. Abdomen with a narrow brownish interrupted dorsocentral vitta; inner margins of markings on terga 3 and 4 divergent cephalad, the markings broadly separated; terga 1+2 grayish pruinose with brownish reflections, not blackened; calyptre intensively yellowish; frontal vitta entire, distinctly separating the parafrontals; wings clear at base*incauta*, n. sp.
- Abdomen with no dorsocentral vitta; inner margin of markings on tergum 3 subparallel; terga 1+2 largely blackish or brownish, concolorous with abdominal marks51
- 51. Thorax largely pale, grayish, with a broad, quadrate, light brownish spot between the dorsocentral bristles immediately caudad of transverse suture; scutellum infuscated on basal half; presutural acrosticals stoutly developed, bristlelike but short; fifth tergum pale, grayish, unmarked*brevicornis* Malloch
- Thorax largely blackish or deep brownish; markings obscured; presutural acrosticals setulose; fifth tergum with marks52
- 52. Parafrontals with a continuous series of uniformly developed bristles to about level with anterior ocellus; processes of fifth sternum more or less reddish tinged along the inner margin; wings blackened basad.*fuscomarginata*, n. sp.
- Parafrontal bristles not continued in series to about level with anterior ocellus, the anterior pairs of bristles in series noticeably stouter developed than those situated caudad; processes of fifth sternum not reddish tinged along inner margin; wings at most brownish infuscated at base, not blackened53
- 53. Parafrontals and parafacials in profile almost obliterated from view; basal segment of hypopygium grayish pollinose; processes of fifth sternum not attenuated at apex; proboscis lightly pollinose.*torreyæ* Johannsen
- Parafrontals and parafacials readily recognized when viewed in profile, at broadest distance equal to half breadth of third antennal seg-

ment; basal segment of hypopygium blackish, shining; processes of fifth sternum attenuated at apex; proboscis glossy, polished.

crassiventris, n. sp.

54. Head with inner pair of vertical bristles stoutly developed, equal in size to the first pair of parafrontal bristles55
- Head with inner pair of vertical bristles fine and slender, not equal in development to first pair of parafrontal bristles60
55. Hind femur with a series of longish bristles on posteroventral surface; grayish brown species56
- Hind femur at most with a series of setulæ on posteroventral surface; grayish white species57
56. Ocellar bristles as long and as robust as first pair of dorsocentral bristles; eyes separated by a distance greater than half that between first pair of dorsocentral bristles; mid femur with bristles on basal third of posteroventral surface fine and setulose.....*acuticornis* Malloch
- Ocellar bristles shorter and weaker developed than first pair of dorsocentral bristles; eyes separated by a distance about equal to half that between first pair of dorsocentral bristles; mid femur with at least 2 or 3 bristles on basal third of posteroventral surface strong and bristlelike.....*surda* Zetterstedt
57. Eyes separated at middle of frons by a distance fully equal to length of third antennal segment; thorax with three intensive, brown vittæ; scutellum with brownish marks laterad58
- Eyes separated at middle of frons by a distance less than length of third antennal segment; thorax with no well defined vittæ and lateral marks on scutellum; processes of fifth sternum entirely blackish.....59
58. Cheek ventrad of eye not higher than breadth of third antennal segment; frontal vitta black, opaque; fore tibia with a posterior bristle at middle*caroli* Malloch
- Cheek ventrad of eye higher than breadth of third antennal segment; frontal vitta whitish pruinose; fore tibia with no posterior bristle at middle*argenteiceps* Malloch
59. Third antennal segment three times as long as wide, reaching to a level below that of ventral margin of eye; parafrontals at base of antennæ noticeably prominent, protruding beyond a level with the base of vibrissæ*clarans*, n. sp.
- Third antennal segment not more than twice as long as wide, not reaching to level of ventral margin of eye; parafrontals not prominent nor protruding, not broader than width of third antennal segment.
cana, n. sp.
60. Mid femur with two stout erect bristles at base of posteroventral surface, in addition to the bristle at base of ventral surface61
- Mid femur with a series of four or more bristles on proximal half of posteroventral surface, if less the bristles are not spinelike62
61. Blackish species; scutellum and basal segment of hypopygium shining, black; wings intensively infuscated*bisetosa*, n. sp.

- Grayish species; scutellum grayish tinged, basal segment of hypopygium largely grayish pollinose; wings tinged, notably adjoining the veins *bisetosa* var. *pruinella*, n. var.
- 62. Hind tibiæ, at least, yellowish, occasionally infuscated 63
- Hind tibiæ blackish 64
- 63. Scutellum with a few fine appressed setulæ on dorsal margin of lateral declivities adjoining apical bristles; parafrontal bristles not continued in series caudad to about level with anterior ocellus; processes of fifth sternum truncate at apex; abdominal markings not well defined *rufitibia* Stein
- Scutellum with no appressed setulæ on upper margin of lateral declivities adjacent the apical bristles; parafrontal bristles continued in series caudad to a level approximating that of anterior ocellus; processes of fifth sternum not truncate at apex; abdominal markings sharply defined *suspecta* Malloch
- 64. Hind femur with a series of bristles situated on proximal two-thirds of posteroventral surface, the longest of which exceeds in length that of apical setæ on posteroventral surface 65
- Hind femur with no series of longish bristles on proximal two-thirds of posteroventral surface, the longest of which does not exceed the length of apical setæ 72
- 65. Eyes separated at narrowest by a distance fully equal to half that between first pair of dorsocentral bristles; parafacials at base of antennæ as wide as length of second antennal segment.

surda Zetterstedt
- Eyes separated at narrowest by a distance less than half that between first pair of dorsocentral bristles; parafacials at base of antennæ not as wide as length of second antennal segment 66
- 66. Hind femur with bristles on proximal half of anteroventral surface fully as long as those on distal half *fibriata*, n. sp.
- Hind femur with bristles on proximal half of anteroventral surface shorter than those on distal half 67
- 67. Third abdominal tergum with large black trapezoidal markings whose proportions largely constrict the lighter pollinose areas to insignificance, frequently the entire tergum together with terga 1+2 almost entirely blackened; supraalar bristle with no short duplicating bristle immediately caudad; costal vein with a series of prominent though not long setulæ on proximal half; scutellum with 2 or 3 appressed setulæ on dorsal margin of lateral declivities adjacent the apical bristles *pluvialis*, n. sp.
- Tergum 3 with markings longer than average breadth, confined to mesal third of tergum, the tergal surface largely grayish white pruinose; supraalar bristle with a weak but distinctive duplicating bristle immediately caudad; costal vein with setulæ not readily distinguished from the surrounding vestiture 68

68. Scutellum with two fine appressed setulæ on dorsal margin of lateral declivities adjacent apical bristles; hind femur with a series of long fine bristles on proximal half of posteroventral surface, the longest exceeding in length the width of femur where situated; hind tibia with apical anterodorsal bristle weakly developed. *baltica* Ringdahl
- Scutellum with no fine appressed setulæ on dorsal margin of lateral declivities adjacent apical bristles; hind femur with a series of short bristles on proximal half of posteroventral surface, the longest of which are not longer than breadth of femur where situated; apical anterodorsal bristle of hind tibia well developed69
69. Halteres blackish; mesopleural series of bristles with a weaker intermediate predorsal bristle; arista pubescent, hairs longer than basal diameter of arista*carbonella* Zetterstedt
- Halteres yellow; mesopleural series of bristles with no weaker predorsal bristle, the intermission bare; arista short pubescent, hairs shorter than basal diameter of arista70
70. Processes of fifth sternum tapering apicad; fore tibia with no posteroventral bristle at middle; caudal segments of abdomen compressed dorsoventrally; second and third sterna longer than wide; hind femur with a preapical posterodorsal bristle in addition to the normal dorsal bristle; wings blackened basad*gibsoni* Malloch
- Processes of fifth sternum broad and truncate toward apex; fore tibia with a median posteroventral bristle; caudal segments of abdomen compressed laterally; second and third sterna as broad as long71
71. Wings tinged with infuscation; thorax and coxæ brownish black, face brownish pollinose; fifth sternum deeply incised, the incision reaching to middle of plate*contractifrons* var. *fumipennis* Zetterstedt
- Wings hyaline throughout; thorax and coxæ lightly grayish white pollinose; face grayish pollinose; fifth sternum shallowly incised, the incision reaching to one-third length of plate*alticola* Malloch
72. Processes of fifth sternum clothed with coarse long black bristles on distal region; mid femur with one basal bristle and a series of 5 or 6 short weak setulose posteroventral bristles on proximal half, the latter not longer than half breadth of femur where situated; eyes separated by a distance greater than breadth of third antennal segment. *pulchra*, n. sp.
- Processes of fifth sternum not clothed with long black bristles on distal half, at most with a few sparsely set bristles; mid femur with a series of 3 or 4 bristles, the longest of which are at least about equal to breadth of femur where situated; eyes separated at narrowest by a distance not greater than breadth of third antennal segment73
73. Abdomen with expansive black subtriangular markings on terga 3 and 4, whose average breadth is greater than length of tergum; basal sclerite of hypopygium black and shining; fifth sternum subshining; wings blackened basad74

- Abdomen with tergal markings confined to dorsum, whose average breadth is not greater than length of tergum; basal sclerite of hypopygium lightly grayish white pollinose; fifth sternum opaque; wings hyaline, at most lightly infuscated at base75
- 74. Calyptræ brownish black*anthrax* Bigot
- Calyptræ whitish, tinged with yellow*magnipunctata* Malloch
- 75. Scutellum with a few appressed setulose hairs on dorsal margin of lateral declivities adjacent apical bristles; sternopleural bristles 1: 1.
reflecta, n. sp.
- Scutellum with no appressed setulose hairs on dorsal margin of lateral declivities adjacent apical bristles; sternopleural bristles, 1: 2.
parvimaculata Stein

Females

- 1. Postsutural dorsocentral bristles usually four pairs2
- Postsutural dorsocentral bristles usually three pairs43
- 2. Mid tibia with a median ventral bristle3
- Mid tibia with no median ventral bristle8
- 3. Hind femur with a series of two or more bristles on proximal half of posteroventral surface; with the anteroventral bristles continued in a distinctive though weaker series to base of femur4
- Hind femur with no series of bristles on proximal half of posteroventral surface, the shortest of which being longer than the apical setæ on posteroventral surface5
- 4. Mesopleural series of bristles with one or more weaker intermediate predorsal bristles; fore tarsus with segments 3 and 4 broadened, similar to segment 5 and dissimilar to segment 1; lower calyptra not restricted in size; costa with no series of prominent setulæ on proximal half*novæ-angliæ* Malloch
- Mesopleural series of bristles with no weaker predorsal bristles, the intermission bare; fore tarsus with segments 2 and 3 not broadened, similar to segment 1 and dissimilar to segment 5; lower calyptra narrower at base than greatest length, restricted in size; costa with a series of prominent setulæ on proximal half*obsoleta* Malloch
- 5. Oral margin protruded slightly beyond a level with base of antennæ when viewed in profile6
- Oral margin not protruded beyond a level with base of antennæ when viewed in profile7
- 6. Scutellum with appressed setulose hairs on dorsal margin of lateral declivities adjacent apical bristles; mesopleural series of bristles with a weaker intermediate predorsal bristle; sternopleural bristles, 1: 2.
hyperborea Boheman
- Scutellum with no setulose hairs on dorsal margin of lateral declivities adjacent apical bristles; mesopleural series of bristles with no pre-apical bristle, the intermission bare; sternopleural bristles, 1: 1.
subrostrata Stein

7. Costa with a few strong accessory setulæ on dorsal surface adjacent the vein *R.* 1 (wing viewed in a horizontal position); lower calyptra reduced in size, very little larger than upper calyptra; scutellum with appressed setulose hairs on dorsal margin of lateral declivities adjacent apical bristles; proboscis lightly pollinose *melanosoma*, n. sp.
- Costa with no accessory setulæ on dorsal surface adjacent vein *R.* 1 (wing viewed in a horizontal position); lower calyptra of normal appearance, larger than upper calyptra; scutellum with no appressed hairs on dorsal margin of lateral declivities adjacent apical bristles; proboscis polished *sectata*, n. sp.
8. Frontal vitta with frontal triangle polished and glossy 9
- Frontal vitta with frontal triangle pruinose, opaque 11
9. Wings conspicuously clouded at cross veins; hind femur with the distal bristle of anterodorsal series situated at a lower (ventrad) plane to those of the series; eyes separated at middle of frons by a distance about equal to greatest breadth of eye when viewed from in front; thorax cinereous gray; abdomen entirely glossy and polished; proboscis lightly pollinose *nigriventris* Zetterstedt
- Wings with cross veins clear; hind femur with the distal bristle of anterodorsal series in the same plane as those of series; eyes separated at middle of frons by a distance greater than maximum breadth of eye when viewed from in front; thorax grayish black; proboscis highly polished 10
10. Halteres blackish; abdomen blackish, shining, unmarked, with trace of brownish pruinescence *concolor* Stein
- Halteres, yellowish, sometimes reddish brown; abdomen lightly grayish pruinose, subshining, with traces of brownish markings.
area Zetterstedt
11. Hind femur with bristles or bristly hairs on basal half of posteroventral surface longer than apical setæ on posteroventral surface 12
- Hind femur with no bristles on basal half of posteroventral surface; bristly hairs if present, not longer than apical setæ on posteroventral surface 31
12. Presutural acrostical bristles stoutly developed, bristle-like, stronger developed than scutellar setulæ; median series of fine bristly hairs on proximal half of posterior surface of hind femur reduced to 2 or 3 in number 13
- Presutural acrostical bristles setulose, not stronger developed than scutellar setulæ 16
13. Mid tibia with one or two longish anterodorsal bristles; mid femur with a short series of bristles on proximal half of anteroventral surface, the longest of which are equal to those on anterior surface 14
- Mid tibia with no anterodorsal bristles, at most a small setulose bristle present; mid femur with, at most, a series of weak bristles on proximal half of anteroventral surface, the longest of which are shorter than those on anterior surface 15

14. Blackish species, subshining; with slight grayish brown pruinescence; mesonotum with vittæ faint and obscure; abdomen with tergal markings small and indefinite; cheeks about as broad as parafacials at base of antennæ *tetrachæta* Malloch
- Pale, grayish species, opaque; with dense whitish gray pruinescence; mesonotum with three distinct brown vittæ; abdomen with large, brownish tergal markings and dorsocentral vitta; cheeks broader than parafacials at base of antennæ *fatima*, n. sp.
15. Eye nearly as high as length of fore tibia; cheeks about as broad as breadth of third antennal segment; fore tibia with no median posterior bristle *argentiventris* var. *occidentalis*, n. var.
- Eye much shorter in height than length of fore tibia; cheeks much higher than breadth of third antennal segment; fore tibia with a median posterior bristle *cretans*, n. sp.
16. Head, thorax and abdomen densely yellowish gray pollinose, the latter ochreous; thorax and abdomen with no marks *narina* Walker
- Thorax and abdomen at least with markings, or, blackish, shining 17
17. Scutellum with setulose hairs on dorsal margin of lateral declivities adjacent apical bristles 18
- Scutellum with no setulose hairs on dorsal margin of lateral declivities adjacent apical bristles 19
18. Oral margin protruded slightly beyond a level with base of antennæ when viewed in profile; antennæ separated at base by a large facial prominence; proboscis polished; large species, 6-7 mm.
..... *almquistii* Holmgren
- Oral margin not protruded beyond a level with base of antennæ when viewed in profile; antennæ separated at base by a narrow, inconspicuous facial elevation; proboscis pollinose *obscuripennis* Stein
19. Halteres blackish or brownish 20
- Halteres yellow, at most with traces of reddish; if reddish, the ovipositor is armed with stout spinules on anal plates, c. f. *comata* 25
20. Oral margin protruded slightly beyond a level with base of antennæ, when viewed in profile 21
- Oral margin not protruded beyond a level with base of antennæ, when viewed in profile 23
21. Mesonotum grayish pruinose, with five well marked vittæ, which are situated along the planes of the macrochætæ; the laterals are fore-shortened at transverse suture; parafrontals grayish pruinose, with brownish infuscation adjoining the frontal vitta; mid tibia with two anterodorsal bristles *sanctipauli* Malloch
- Mesonotum largely infuscated, with trace of darker streaks between the planes of the macrochætæ; parafrontals entirely brownish infuscated; mid tibia with at most one short anterodorsal bristle 21a
- 21a. Scutellum and presutural area of mesonotum sparsely setulose, the presutural acrosticals distinctly developed; scutellum with a pale grayish dorsocentral streak, and with two blackish areas laterad.
..... *megastoma* Boheman

- Scutellum and presutural area of mesonotum densely setulose, the presutural acrosticals not readily distinguished; scutellum entirely blackish infuscated22
- 22. Eyes with a few hairs; abdomen grayish pruinulent, with black markings*tristiola* Zetterstedt
- Eyes bare; abdomen with no marks*extensa* Malloch
- 23. Mesopleura and scutellum largely blackened; mesonotum with no trace of vittæ; parafrontals entirely brownish infuscated.....*alberta*, n. sp.
- Mesopleura and scutellum largely grayish pruinulent; mesonotum largely grayish with brownish vittæ; parafrontals grayish pruinulent24
- 24. Ovipositor with spinules on anal plates; frontal vitta wider than distance between oral vibrissæ, about three times as wide as each parafrontal*nobilis* Stein
- Ovipositor with fine setulæ on suranal plates; frontal vitta narrower than distance between oral vibrissæ, about equal to twice breadth of each parafrontal*setilamellata*, n. sp.
- 25. Subcostal vein with a few setulose hairs on under surface proximad of humeral cross vein; terga 3, 4, and 5 with paired brownish marks on lateral (ventral) areas, separated from the normal dorsal markings; parafacials at base of antennæ equal to half diameter of eye immediately caudad of this position*setinervis*, n. sp.
- Subcostal vein with no setulose hairs on under surface proximad of humeral cross vein; terga 3, 4, and 5 with no lateral marks other than those that are continuous with those on dorsum; parafacials at base of antennæ less than half diameter of eye immediately caudad of this position26
- 26. Ovipositor armed with spinules on anal plates; calyptræ white27
- Ovipositor clothed with fine setulæ on anal plates; calyptræ yellowish28
- 27. Mid femur with a series of posteroventral bristles; proboscis pollinose; first abdominal sternum bare*comata* n. sp.
- Mid femur with no posteroventral bristles; proboscis polished, shining; first abdominal sternum with a few setulæ*placida*, n. sp.
- 28. Hind femur with a complete series of strong anteroventral bristles; abdomen with conspicuous brownish patches on ventral aspect of terga*compuncta* Wiedemann
- Hind femur with a series of 4 or 5 bristles confined to distal half of anteroventral surface, with a series of bristly hairs on proximal half; abdomen with no brownish areas on ventral aspect of terga29
- 29. Proboscis pollinose; first abdominal sternum with a few setulæ; thorax with three heavy dark brown vittæ and a broad fuscous area immediately caudad of transverse suture between the dorsocentral bristles. *alliterata*, n. sp.
- Proboscis polished; first abdominal sternum bare; thorax with at most a well marked median vitta, the sublaterals obscure.....30

30. Tibiæ more or less yellowish; cheek higher than breadth of parafacial at base of antennæ, the parafacials markedly restricted ventrad; fore tibia with no median posterior bristle *rufitarsis* Stein
- Tibiæ entirely black; cheek not higher than breadth of parafacial at base of antennæ, parafacials at narrowest as broad as width of third antennal segment; fore tibia with one or more median posterior bristles *incauta*, n. sp.
31. Mesopleural series of bristles with a weaker intermediate predorsal bristle 32
- Mesopleural series of bristles with no predorsal bristle, the intermission bare 34
32. Thorax with three narrow distinctive brownish vittæ between the dorso-central bristles; calyptræ yellowish *trilineata*, n. sp.
- Thorax with a single vitta between the dorsocentral bristles, at most; calyptræ whitish 33
33. Scutellum with appressed setulose hairs on dorsal margin of lateral declivities adjacent apical bristles; ovipositor with fine spinules on subanal plate; blackish species *addicta*, n. sp.
- Scutellum with no appressed setulose hairs on dorsal margin of lateral declivities adjacent apical bristles; ovipositor with fine setulose hairs on subanal plate; grayish species *imitatrix* Malloch
34. Presutural acrosticals irregularly paired, bristlelike, stronger developed than the scutellar setulæ; frontal vitta almost obliterated by the pronounced ocellar triangle, the latter is densely pollinose, concolorous with parafrontals and reaches to base of antennæ; calyptræ white.
- *brevicornis* Malloch
- Presutural acrosticals setulose, not stronger developed than scutellar setulæ 35
35. Discal area of mesonotum with dense seal brown infuscation covering uniformly the postsutural and presutural regions; mesopleura pearlescent gray; parafrontals seal brown infuscated; frontal vitta rufous cephalad; mid femur with posteroventral bristles setulose; proboscis pollinose *torreyæ* Johannsen
- Discal area of mesonotum vittate, not entirely infuscated; proboscis polished, glossy 36
36. Scutellum with appressed setulose hairs on dorsal margin of lateral declivities adjacent apical bristles; hind tibia with one anterodorsal bristle; ovipositor with fine setulæ on anal plates.
- *denudata* Holmgren
- Scutellum with no appressed setulose hairs on dorsal margin of lateral declivities adjacent apical bristles; hind tibia with two or more anterodorsal bristles 37
37. Ovipositor with spinules on anal plates 38
- Ovipositor with fine setulæ only on anal plates 40
38. Mid tibia with 2 or more well developed anterodorsal bristles; wings

- infuscated, cross veins faintly clouded; costa with a short series of stoutly developed setulæ proximad of costal thorn, the setulæ fully as long as width of costa *sospita*, n. sp.
- Mid tibia with at most one anterodorsal bristle; wings clear, hyaline, cross veins clear; costal setulæ proximad of costal thorn weakly developed 39
39. Pale grayish species; lunule at base of antennæ silvery pruinose; first abdominal sternum with a few hairs or setulæ; parafrontals with brownish infuscation confined to a narrow border adjacent frontal vitta *placida*, n. sp.
- Dark grayish species; lunule at base of antennæ brownish black pruinose; first abdominal sternum bare; parafrontals broadly brownish infuscated to margin of eye *monacantha* Collin
40. Sternopleura with a noticeable tuft of bristles ventrad; parafacials broader and cheeks higher than length of third antennal segment. *pulvicrura*, n. sp.
- Sternopleura with bristles not tufted ventrad, arranged more or less in series; parafacials and cheeks at narrowest dimensions not more than length of third antennal segment 41
41. Parafacials at greatest breadth and cheeks at greatest height about equal to length of third antennal segment; calyptre intensively yellowish; buccæ with a single series of sparsely set bristles along ventral margin *incauta*, n. sp.
- Parafacials at greatest breadth and cheeks at greatest height not equal to length of third antennal segment; calyptre, at most, tinged; buccæ with a series of closely set setulæ and bristles along ventral margin 42
42. Mid tibia with one or more median anterodorsal bristles; *m-cu* cross vein clouded; abdomen subshining, highly pruinose, with large broad subtriangular marks on terga 3 and 4 that extend ventrad along the caudal margin of each segment; scutellum with blackish areas at basal angles *fuscomarginata*, n. sp.
- Mid tibia with no median anterodorsal bristle; *m-cu* cross vein clear; abdomen densely pollinose, opaque; with comparatively small brownish marks on terga 3 and 4, restricted to dorsum; scutellum entirely grayish pollinose *crassiventris*, n. sp.
43. Tibiæ yellowish 44
- Tibiæ blackish 45
44. Scutellum with appressed setulose hairs on dorsal margin of lateral declivities adjacent apical bristles; mid tibia with no anterodorsal bristle; fore tibia with no median posterior bristle *rufitibia* Stein
- Scutellum with no appressed setulose hairs on dorsal margin of lateral declivities adjacent apical bristles; mid tibia with 1 or 2 anterodorsal bristles; fore tibia with one posterior bristle *suspecta* Malloch

45. Mesonotum, scutellum and frons largely covered with deep seal brown coloration; humeral callosity with one bristle (the inner bristle weakly developed, setulose); proboscis pollinose, not shining.
torreyæ Johannsen
- Mesonotum, scutellum, and frons largely grayish, at most the former vittate, and the scutellum with spots at basal angles; humeral callosity with two bristles46
46. Ovipositor with spinules on anal plate47
- Ovipositor with fine hairs or setulæ on anal plates; no spinules.....49
47. Scutellum with preapical bristles well developed, in size at least as robust as basal bristles; mid femur with one or two strong erect bristles on basal third of posteroventral surface.....*bisetosa*, n. sp.
- Scutellum with no noticeable preapical bristles, if present, they are weaker than the basal bristles; with setulose hairs on dorsal margin of lateral declivities adjacent the apical bristles.....48
48. Mid femur with a series of bristles on proximal half of posteroventral surface; fore tibia with a median posterior bristle; *m-cu* cross vein clear*surda* Zetterstedt
- Mid femur without, or with but one or two widely separated bristles on proximal half of posteroventral surface; fore tibia with no posterior bristle at middle; *m-cu* cross vein cloudy.
acuticornis Malloch
49. Costa with a series of strong erect setulæ between the junctures of auxilliary and humeral cross vein with costa, the setulæ longer than diameter of costa; scutellum with setulose hairs on dorsal margin adjacent apical bristles; vertical bristles of head separated by a distance about equal to that between first pair of dorsocentral bristles.
pluvialis, n. sp.
- Costa with no series of prominent setulæ between the junctures of auxilliary and humeral cross vein with costa; scutellum with no setulose hairs on dorsal margin of lateral declivities adjacent apical bristles; vertical bristles of head separated by a distance less than that between first pair of dorsocentral bristles50
50. Mid tibia with no anterodorsal bristle; mid femur with 1 or 2 bristles on proximal third of posteroventral surface; proboscis pollinose; scutellum entirely pale grayish51
- Mid tibia with 1 or 2 anterodorsal bristles; mid femur with a series of at least 3 or 4 bristles on proximal half of posteroventral surface; proboscis shining; scutellum with trace of fuscous areas at basal angles52
51. Scutellum with setulose hairs on dorsal margin of lateral declivities adjacent apical bristles; cheeks at narrowest height about one fourth that of eye; fore tibia with no median posterior bristle; fore coxæ with the inner series of bristles on anterior surface not robust.
reflecta, n. sp.

- Scutellum with no setulose hairs on dorsal margin of lateral declivities adjacent apical bristles; cheeks at narrowest height about one sixth that of eye; fore tibia with 1 or 2 median posterior bristles; fore coxæ with the inner series of bristles on anterior surface robustly developed*parvimaculata* Stein
- 52. Hind femur with a series of longish bristles restricted to median third of posteroventral surface, the proximal third devoid of bristles.
gibsoni Malloch
- Hind femur with, at most, a series of longish setulæ on proximal third of posteroventral surface, the median third with no longish bristles..53
- 53. Width of parafacials at base of antennæ, when viewed in profile, not less than one third the diameter of eye immediately caudad of this position; cheeks about as high as one third that of eye.
incauta, n. sp.
- Width of parafacials at base of antennæ not equal in breadth to one third the diameter of eye immediately caudad of this position; cheeks not as high as one third that of eye54
- 54. Parafrontals with seal brown infuscation along the border of frontal vitta; frontal vitta and frontal triangle with seal brown pruinescence55
- Parafrontals entirely slate gray pruinosecent, with no brownish infuscation along the margin of frontal vitta; frontal vitta and frontal triangle with grayish pruinescence.....56
- 55. Both upper and lower calyptra intensively yellowish; parafacials at narrowest breadth narrower than width of third antennal segment*anthrax* Bigot
- Calyptræ yellowish tinged; parafacials at narrowest breadth at least as wide as third antennal segment*magnipunctata* Malloch
- 56. Hind femur with anteroventral series of bristles continued to base; thorax with a median vitta.
contractifrons var. *fumipennis* Zetterstedt
- Hind femur with anteroventral series of bristles confined to distal two-thirds, not continued to base; thorax with no median vitta.
alticola Malloch

(To be Continued)

COLEOPTERA AND DIPTERA COLLECTED FROM A
NEW JERSEY SHEEP PASTURE¹

BY J. W. WILSON

Domestic animals are known to harbor large numbers of parasitic worms, some species of which, notably among the tape-worms, have unknown life histories with probable intermediate stages in insects. Hall (1929) in a recent paper on "Arthropods as Intermediate Hosts of Helminths" lists thirty-four species of insects which serve as intermediate hosts of Cestoda, fifty-three for Trematoda, one hundred and forty-one for Nematoda, and fifteen for Acanthocephala. Members of the orders Coleoptera and Diptera appear most frequently in such a list, with Siphonaptera, Lepidoptera, Odonata, Mallophaga, Dermaptera, Trichoptera, and Ephemera also represented. Insect collections with special reference to those found in the dung of various domestic animals, thus serve as a method of orienting research on the life histories of certain of the helminths parasitizing such animals.

During the summer of 1928, from early May to early September, collections of insects, with particular reference to those breeding and found about sheep dung, were made from the sheep pastures and buildings at the Rockefeller Institute for Medical Research at Princeton, New Jersey. The effort was made to conduct a thorough survey of the coleopterous and dipterous fauna in such an environment. The collections show forty-three species of Coleoptera belonging to seven families, and sixty-four species of Diptera belonging to twenty-two families. During the course of the study it was found that very little information about the life history of many of these insects is available. Since a knowledge of their life histories is necessary in working out the life history of parasitic worms for which some of these insects may act as intermediate hosts, notes collected during the summer are included.

¹ From the Department of Animal and Plant Pathology, Rockefeller Institute for Medical Research, Princeton, N. J.

The Diptera were identified by Mr. C. W. Johnson, of The Boston Society of Natural History, and the Staphylinidae by Mr. W. J. Brown, of The Bureau of Entomology, Ottawa, Canada. I wish to acknowledge my indebtedness to these workers for their assistance, as well to Dr. Norman R. Stoll, of The Rockefeller Institute, whose interest stimulated this investigation.

LIST OF COLEOPTERA COLLECTED

(* rare; ** moderately abundant; *** abundant)

Carabidæ

- * *Stenolophus dissimilis* Dej.

Hydrophilidæ

- * *Phaenonotum estriatum* Say (May, June)
- ** *Sphaeridium scarabaeoides* Linn. (May, June)
- ** *Sphaeridium bipustulatum* Fabr. (May, June)
- *** *Cercyon praetextatus* Say (May to Sept.)
- *** *Cercyon haemorrhoidalis* Fabr. (May to Sept.)
- *** *Cercyon pygmaeus* Illig. (May to Sept.)

Staphylinidæ

- * *Olophrum obtectum* Er. (May)
- * *Oxytelus insignitus* Grav. (May)
- * *Stenus punctatus* Er. (May, June)
- * *Paederus littorarius* Grav. (May)
- * *Aderocharis corticinus* Grav. (June)
- * *Trachysectus confluentus* Say (May, June)
- * *Stilicus latiusculus* Csy. (May)
- *** *Gyrophypnus obsidanus* Melsh. (May, June)
- ** *Gyrophypnus hamatus* Say (May, June)
- * *Gyrophypnus* sp. (May)
- * *Neobisnius sobrinus* Er. (May)
- * *Philonthus discoideus* Grav. (May)
- * *Philonthus micans* Grav. (May)
- * *Philonthus cunctans* Horn (June)
- * *Philonthus brunneus* Grav. (June, July)
- * *Belonchus formosus* Grav. (June)
- ** *Staphylinus cinnamopterus* Grav. (May, June)

- * *Quedius molochinus* Grav. (May)
- *** *Quedius capucinus* Grav. (May to Sept.)
- * *Tachinus limbatus* Melsh. (May)
- * *Erchomus ventriculus* Say (May)

Histeridæ

- * *Hister curtatus* Lec. (May, June)
- * *Hister americanus* Payk. (May, June)

Byrrhidæ

- * *Byrrhus americanus* Lec. (May)

Nitidulidæ

- * *Glischrochilus fasciatus* Oliv. (May, June)

Scarabaeidæ

- *** *Onthophagus hecate* Panz. (May to Sept.)
- *** *Onthophagus pennsylvanicus* Har. (June to Sept.)
- * *Aphodius fossor* Linn. (May)
- * *Aphodius erraticus* Linn. (May)
- *** *Aphodius fimetarius* Linn. (May to Sept.)
- *** *Aphodius granarius* Linn. (May to Sept.)
- ** *Aphodius stercorosus* Melsh. (May to Sept.)
- *** *Aphodius distinctus* Mull. (May to Sept.)
- * *Aphodius terminalis* Say (July to Sept.)
- *** *Ataenius cognatus* Lec. (May to Sept.)
- * *Trox insularis* Chev. (May)

NOTES ON COLEOPTERA COLLECTED

Carabidæ

Most of the members of this family are predacious in habit, living upon other insects. Only one species, *Stenolophus dissimilis*, was captured under the dry sheep dung, and this species was very scarce. Only a few specimens were taken during the early part of the summer.

Hydrophilidæ

The majority of the members of this family are aquatic in habit. One subfamily, however, is terrestrial, living in moist

soil and dung. Representatives of three genera of the subfamily Sphæridiinae were captured in sheep dung and dung mixed with straw bedding. The dung and bedding had been piled in a very moist place for about a week when it was first examined. A few specimens of *Phænonotum estriatum* were captured in this pile of bedding during the early part of the summer. Specimens of *Sphæridium scarabæoides* and *S. bipustulatum* were also taken in large numbers from this wet bedding during the early part of the summer but were never found under the dung in the pasture. All three species of the genus *Cercyon* were abundant in both the wet bedding and the dung in the pasture throughout the season.

Staphylinidæ

The members of this family usually feed upon decaying animal and vegetable matter. Many of the forms listed here were taken early in May from a pile of bedding which had remained undisturbed through the winter in the pasture. It appeared that these forms had overwintered in this old bedding. *Gyrophypnus obsidanus*, *G. hamatus*, *Staphylinus cinnamopterus*, and *Quedius capucinus* were the most abundant of the Staphylinidæ. These four species were taken both in the dung and the wet discarded bedding, but the first three were only captured during the early part of the season while the latter was present during the whole of the summer.

Histeridæ

This family of beetles includes about four hundred species described from America which are usually found about carrion and decaying substances. The two species, *Hister curtatus* and *H. americanus* were only occasionally found in the sheep dung during May and June.

Byrrhidæ

The Byrrhidæ are usually found at the roots of trees and grass; a few live under the bark of trees. Only one specimen of *Byrrhus americanus* was captured on May 4 in the pile of old bedding which had been left in the pasture through the winter.

Nitidulidæ

Most of the species of this family feed on the sap of trees, but a few are found on fungi or carrion. *Glischrochilus fasciatus*

was collected in small numbers in the very moist portions of the discarded bedding during the latter part of May and early June.

Scarabæidæ

Representatives of four genera of this very large family were found in the sheep dung and discarded bedding. *Onthophagus hecate* was abundant in the dung, but the eggs were laid in small pellets which were placed in shallow tunnels just beneath the dung pile. This species was present in large numbers during the entire summer. *Onthophagus pennsylvanicus*, the smaller of the two species, was first taken in June but it was more abundant during the latter part of the season. Like *O. hecate*, *O. pennsylvanicus* places its eggs in pellets of dung which are taken into shallow tunnels beneath the dung piles.

Seven species of *Aphodius* were collected in the sheep dung and discarded bedding. Only a few specimens of *A. fossor* and *A. erraticus* were taken from the wet discarded bedding during the latter part of May. *A. granarius* and *A. fimetarius* were abundant during the whole season, and were taken from cow, horse, and rabbit dung on the Institute farm as well as from the sheep dung. *A. distinctus* was rather abundant from May to September, while *A. stercorosus* was more abundant during the latter part of the summer. *A. terminalis* was not collected until the latter part of the summer. *Atenius cognatus* was very abundant during most of the season. Only one specimen of *Trox insularis* was collected on May 8 in the old bedding left from the previous year.

NOTES ON THE LIFE HISTORY OF APHODIUS

During the first and second weeks of May collections were made in the pasture used the previous year for sheep. In one corner of the pasture an old pile of bedding had been allowed to remain undisturbed throughout the winter. Large numbers of *Aphodius granarius* and *A. fimetarius* were found hibernating in this old bedding. These were the only species of *Aphodius* found overwintering in the sheep pasture.

On May 16 many specimens of *A. granarius* and *A. fimetarius* were collected under the fresh sheep droppings in the adjoining

pasture. The first specimens of *A. distinctus* were also taken on May 16 under the fresh droppings. The dung hills were examined daily but it was not until May 28 that *A. stercorosus* was taken. On the same date a pile of bedding, which had been removed from the pens for about a week, was examined and a few specimens of *A. fossor* and *A. erraticus* were collected. These two latter species were never taken in the pasture under the dung. *A. granarius* and *A. fimetarius* were the first of the seven species of *Aphodius* to appear in the sheep pasture, and *A. granarius* was the most abundant of all the species throughout the entire season.

Several pair of *A. granarius* and *A. fimetarius* were taken into the laboratory and placed in pill boxes with a small pellet of dung. Only a few individuals of *A. fimetarius* were reared, and these individuals passed through the different stages of their life cycle in approximately the same time as required by *A. granarius*.

On June 2 eggs of *A. granarius* were found in the pasture. These eggs were taken into the laboratory where they hatched on June 4, but no larvæ were observed in the pasture until June 8. The first eggs laid by the adults brought into the laboratory were deposited on June 4, two days after the first eggs were observed in the pasture. Throughout the season the adult *A. granarius* preferred the dung piles which had dried out and formed a hard crust over the surface. The eggs are laid just beneath this hard dry crust. By the time the dung hills had dried out sufficiently to attract the adult beetles the fly larvæ, which had been feeding and developing in the dung hills, had already pupated.

The eggs are smooth, opaque, and almost spherical or oval in shape. The average length of ten eggs was .80 mm., and the average width was .56 mm. Eggs deposited by the beetles in the laboratory hatched in four to seven days.

The newly hatched larvæ are about 2 mm. in length, and have a light brown head and white body. They have the typical shape of scarabæid larvæ, and rest with the abdomen folded against the fore part of the body as do most scarabæid larvæ. The larvæ were kept in pill boxes in small pellets of dung, but it was very difficult to maintain the proper amount of moisture for the de-

velopment. Many of them died because of too much moisture, and some died because of too little moisture. I was unable to determine the length of the various larval instars excepting the first which lasts for three or four days.

During the latter part of July the larvæ became full grown and began pupating. The first larva to pupate completed the process on July 13, while July 23 was the first date upon which the first pupa was observed in the pasture. The length of the pupal stage of specimens reared in the laboratory varied from six to ten days, with an average length of nine days.

The first adults of the new generation emerged on July 19, but the new generation of adults did not begin to emerge in large numbers until the second week in August. These newly emerged adults were much lighter in color than the parent generation, and gradually became darker up to the time of hibernation. The adults remained in the pasture feeding in the dung until fall when they hibernated.

LIST OF DIPTERA COLLECTED

(* Collected once or seldom; ** moderately abundant; *** abundant)

Psychodidæ

- ✓ *** *Psychoda minuta* Banks (May to Sept.)

Sciaridæ

- *** *Sciara* sp. (May and June)

Scatopsidæ

- ✓ *** *Scatopse notata* Linn. (May and June)

Tabanidæ

- ✓ * *Chrysops niger* Macq. (June)

Therevidæ

- ✓ * *Psilocephala hæmorrhoidalis* Macq. (June)

Dolichopididæ

- * *Gymnopternus* sp. (June)

Empididæ

- * *Euhybos triplex* Wlk. (June)
- ** *Rhamphomyia mutabilis* Lw. (May and June)

Lonchopteridæ

- * *Lonchoptera furcata* var. *lacustris* Mg. (June)

Tachinidæ

- * *Voria ruralis* Meig. (June)
- * *Metachæta helymus* Walt. (June)

Dexiidæ

- * *Dinera futilis* West. (May)

Sarcophagidæ

- * *Helicobia helcis* Town. (May to Sept.)
- ** *Sarcophaga assidua* Wlk. (May to Sept.)
- ** *Sarcophaga bisetosa* Park. (May to Sept.)
- * *Sarcophaga cimbicis* Town. (May to Sept.)
- ** *Sarcophaga communis* Park. (May to Sept.)
- * *Sarcophaga sinuata* Meig. (May to Sept.)

Calliphoridæ

- * *Cyanomyia cadaverina* Desv. (June and July)
- * *Calliphora erythrocephala* Meig. (June and July)
- ** *Lucilia sericata* Meig. (June and July)

Muscidæ

- ** *Stomoxys calcitrans* Linn. (June to Sept.)
- ** *Musca domestica* Linn. (May to Sept.)
- * *Muscina stabulans* Fall. (June to Sept.)
- * *Myiospilia meditabunda* Fab. (June to Sept.)

Anthomyiidæ

(All species of this family, Anthomyiidæ, were collected from May to Sept.)

- ** *Hebecnema umbratica* Meig.
- ** *Ophyra leucostoma* Wied.

- ** *Fannia canicularis* Linn.
- ** *Fannia serena* Fall.
- ** *Coenosia flavicoxa* Stein
- ** *Coenosia lata* Wlk.
- ** *Coenosia rufitibia* Stein.
- ** *Schoenomyza chrysostoma* Lw.
- ** *Anthomyia* sp.
- ** *Hammomyia johnsoni* Stein
- ** *Hylemyia antiqua* Meig.
- ✓ *** *Hylemyia cilicrura* Rond.
- ✓ *** *Hylemyia cinerella* Fall.

Scatophagidæ

- ✓ * *Parellelomma pleuritica* Lw. (June)
- ✓ *** *Scatophaga furcata* Say (May to Sept.)
- ✓ ** *Scatophaga stercoraria* Linn. (May to Sept.)

Borboridæ

- ✓ *** *Sphaerocera subsultans* Fab. (May to Sept.)
- *** *Leptocera frontinalis* Fall. (May to Sept.)
- ✓ *** *Leptocera longicosta* Spuler. (May to Sept.)
- ✓ *** *Leptocera ordinaria* Spuler. (May to Sept.)
- ✓ *** *Borborus equinus* Fall. (May to Sept.)

Sciomyidæ

- ✓ * *Sepedon pusillus* Lw. (June)

Ortalidæ

- ✓ * *Chaetopsis fulvifrons* Macq. (June)

Sepsidæ

- ✓ ** *Sepsis signifera* var. *curvitibia* Mel. (May to Sept.)
- ✓ *** *Sepsis violacea* Meig. (May to Sept.)
- ✓ ** *Nemopoda cylindrica* Fab. (May, June)
- ✓ ** *Meroplus stercorarius* Desv. (May, June)
- ✓ ** *Themira putris* Linn. (May, June)

Chloropidæ

- * *Diplotoxa versicolor* Lw. (June)
- * *Chlorops obscuricornis* Lw. (June)

- * *Hippelates flavipes* Lw. (June)
- * *Hippelates pusio* Lw. (June)
- * *Hippelates subvittatus* Mall. (June)
- * *Botanobia frit* Linn. (Coll. June)

Ochthiphilidæ

- * *Ochthiphilia polystigma* Meig. (June)

Agromyzidæ

- * *Agromyza parvicornis* Lw. (June)
- * *Cerodontha dorsalis* Lw. (June)

Collections were also made in the barn where experimental animals were kept during the entire summer. The following list of Diptera includes the species taken from the barn.

Calliphoridæ

- * *Cynomyia cadaverina* Desv. (June, July)
- * *Calliphora erythrocephala* Meig. (June, July)
- ** *Lucilia sericata* Meig. (June, July)

Muscidæ

- ** *Stomoxys calcitrans* Linn. (June to Sept.)
- *** *Musca domestica* Linn. (May to Sept.)
- * *Muscina stabulans* Fall. (June to Sept.)

Anthomyiidæ

- ** *Fannia canicularis* Linn. (June)
- ** *Hylemyia cinerella* Fall (June)

Borboridæ

- ** *Sphaerocera subsultans* Fab. (May to Sept.)
- *** *Leptocera frontinalis* Fall. (May to Sept.)
- *** *Leptocera longicosta* Spuler. (May to Sept.)
- *** *Leptocera ordinaria* Spuler. (May to Sept.)

Sepsidæ

- *** *Sepsis violacea* Meig. (May to Sept.)
- ** *Meroplus stercorarius* Desv. (May, June)

Chloropidæ

* *Hippelates flavipes* Lw. (June)

* *Botanobia frit* Linn. (June)

NOTES ON THE DIPTERA COLLECTED

Psychodidæ

The larvæ of this family are found in decaying vegetable matter, in dung, or in streams. *Psychoda minuta* was very abundant around the shed and shaded places where the dung remained damp. Large numbers of the adults emerged from samples of dung exposed in the pasture. On May 20 a sample of dung was exposed for 48 hours, and on May 28 the adult *Psychoda* began to emerge. From other samples of dung exposed in the same manner the adults did not begin to emerge until after thirteen days.

Sciaridæ

The members of this family formerly belonged to the family Mycetophilidæ and are commonly known as fungus-gnats. The larvæ live in a variety of conditions: being found among decaying leaves, vegetable mold, cow dung, sheep dung, and under bark of trees. One specimen of *Sciara* was recovered on June 19 from dung exposed on June 7, requiring 12 days for its development. The adults were numerous under the shade of a tree where the sheep rested during May, but they were not captured during the latter part of the season.

Scatopsidæ

This family is closely related to the Sciaridæ, and the larvæ inhabit about the same places as the Sciaridæ. *Scatopse notata* was very common during May and June, but adults were not recovered from the samples of dung exposed.

Tabanidæ

The members of this family lay their eggs on stems of plants or exposed stones in the streams. The larvæ are aquatic or semi-aquatic, and predacious as far as is known. Some feed upon the larvæ of insects, and others upon snails.

Several specimens of *Chrysops niger* were captured near the sheep during June.

Therevidæ

This group of flies resembles the Asilidæ somewhat, both in appearance and habit. The adults are predacious, living largely upon other insects. The larvae are said to be predacious as well as feeding upon decaying vegetable and animal matter. Only one specimen of *Psilocephala haemorrhoidalis* was captured in June.

Dolichopididæ

Only one specimen of *Gymnopternus* sp. was captured, although Howard (1900) reports breeding *Diaphorus leucostomus* and *D. sodalis* from human excrement in numbers.

Empididæ

Euhybos triplex was captured in the pasture early in June by sweeping. *Rhamphomyia mutabilis* was captured about the the sheep dung during May and June. Howard (1900) captured *Rhamphomyia manca* on human feces.

Lonchopteridæ

Lonchoptera furcata var. *lacustris* was collected in the sheep pasture by sweeping with a net near the small stream which flows through the pasture. Williston (1908) states that the larvæ of flies belonging to this family live under leaves and decaying vegetable matter.

Tachinidæ

The larvæ of flies belonging to this family are parasitic, usually attacking caterpillars, but they have been reared from members of several other orders of insects. The adults live on plant juices, which probably accounts for the capture of *Voria ruralis* and *Metachaeta helymus*, as these two flies were taken during June by sweeping in the pasture.

Dexiidæ

The Dexiidæ resemble the Tachinidæ very closely in structure, habits and life history. *Dinera futilis* was the only species of this family collected. A few specimens were captured in May.

Sarcophagidæ

The flies of this family have a very wide range of habitat; some living as the family name implies in flesh, some in dung, others in decaying vegetable matter and fruits, while others are parasitic on insects, and one genus is parasitic on mammals.

Sarcophaga assidua and *S. communis* were bred from dung collected from the pasture on June 11. The adults began to emerge on June 22, eleven days after the sample was collected. On June 15 dung was exposed for 24 hours. Adults of these two species emerged on the 27th of June and continued to emerge until the 6th of July, requiring from 12 to 21 days to complete their development. *Helicobia helicis*, *Sarcophaga bisetosa*, *S. cimbicis* and *S. sinuata* were occasionally collected during the summer about the dung.

Calliphoridæ

Cyanomyia cadaverina, *Calliphora erythrocephala*, and *Lucilia sericata* were collected in the barn where experimental animals were kept, but were not collected in the pasture. The first two species were rather scarce during June and July, but the latter species was moderately abundant.

Muscidæ

A number of specimens of *Stomoxys calcitrans* was collected in the barn, but was not collected in the pasture, although this species breeds freely in horse manure. This species was moderately abundant from June to September. *Musca domestica* was present in large numbers during the entire season. A few specimens of *Muscina stabulans* was also taken in the barn during June, July and August.

Howard (1900) reared specimens of *Myiospilia mediatubunda* from human excrement in twelve days. Specimens reared in sheep dung required eighteen days for their development. Adult flies emerged from samples of dung on June 23 and 25, which had been exposed June 5 and 7.

Anthomyiidæ

Many of the larvæ of this family breed in excrement, others in decaying animal and vegetable matter, and some are parasitic

upon other insects. Several forms have been known to produce internal myasis, retaining their vitality when taken into the stomach with spoiled vegetables and when fully developed are voided with the feces.

Thirteen species belonging to this family were collected in the pasture near the dung, but only *Hylemyia cilicrura* and *H. cinerella* were reared from the sheep dung. These two species were very abundant during the summer, while the remaining eleven species were moderately abundant.

The eggs of *Hylemyia cilicrura* and *H. cinerella* are laid in clusters in crevices of the dung, where they are often found in very large numbers. The eggs are long, cylindrical, slightly curved, and creamy white in color. They hatch in about 24 hours, and the larvæ become full grown in four to five days. These two species require nine to ten days to develop from the egg to the adult stage.

Scatophagidæ

A single specimen of *Parellelomma pleuritica* was taken in the pasture. *Scatophaga furcata* was very abundant about the sheep dung during May and June, but it was not as abundant during July and August. On June 5 dung was exposed for 24 hours from which adult *S. furcata* emerged on the 29th of June, 24 days after exposure. Another specimen of dung collected from the pasture on the same date produced adult flies 20 days later. Still another specimen collected from the pasture on June 11 produced adult flies in 15 days.

Scatophaga stercoraria was also bred from these same specimens of dung in 20 to 24 days.

Borboridæ

The flies of this family breed in almost any kind of dung. The five species represented in this list were also collected at a dump for rabbit dung and bedding where they were abundant throughout the summer.

A few specimens of *Sphaerocerus subsultans* were bred from dung exposed for two hours on June 6. The adults emerged on June 21, giving a fifteen day period for their development. Howard (1900) bred this species from human excrement in 8 days.

Wilson and Stoll (1929) have in another place noted the ease of rearing in the laboratory two species of *Leptocera* which were encountered. Several generations of *L. longicosta* and *L. ordinaria* were bred without difficulty on sterilized sheep dung. The dung was placed in pint milk bottles and male and female flies placed within them. The new generation of *L. longicosta* emerged in 11 to 14 days, the average period being 12 days, while *L. ordinaria* emerged in 9 to 10 days. Twenty newly emerged male and female *L. longicosta* were placed in shell phials upon sterilized sheep dung. The new generation began to emerge twelve days after the parent generation was placed in the phials. The average progeny of these 20 were 146.5, with a ratio of 116 males to 100 females.

Borborus equinus was bred from the sheep dung, requiring 9 to 15 days for its development.

Sciomyzidæ

A few specimens of *Sepedon pusillus* were collected by sweeping in the pasture in June. The larvæ of this family are aquatic and do not breed in dung.

Ortalidæ

The larvæ of this family have been found breeding in widely differing habitats, such as in growing plants, under the bark of dead trees, on lepidopterous larvæ, and in excrement.

Only a few specimens of *Chaetopsis fulvifrons* were captured in June.

Sepsidæ

Sepsis violacea was abundant about the sheep dung during the summer months, and was recovered from most of the samples of dung taken from the pasture. The adult flies appeared after 11 or 12 days. *Sepsis signifera* var. *curvittibia* was moderately abundant about the dung, and was bred from the dung in the same time required by *S. violacea*. *Nemopoda cylindrica*, *Meroplus stercorarius*, and *Themira putris* were moderately abundant during the latter part of May and all of June, but these species were not reared from samples of dung collected in the pasture.

Chloropidæ

Some of the larvæ belonging to this family live in the stems of grasses, some live on the egg shells and exuviae of insects, and others live in excrement.

Six species belonging to four genera were collected in the pasture, but none of them were bred from the dung. *Hippelates flavipes* and *Botanobia frit* were also collected in the barn during June.

Ochthiphilidæ

Only one specimen of *Ochthiphilia polystigma* was captured by sweeping in the pasture in June.

Agromyzidæ

Agromyza parvicornis and *Cerodontha dorsalis* were collected during June, but were not bred from sheep dung. However, *Cerodontha dorsalis* has been bred from human excrement (Howard, 1900).

SUMMARY

A list is given of forty-three species of Coleoptera belonging to seven families, and sixty-four species of Diptera belonging to twenty-two families, collected from a sheep pasture, mostly about the dung, near Princeton, New Jersey, during the summer of 1928. It is believed that they represent a good sampling of the beetle and fly fauna of such an environment.

Of the Coleoptera included in this list the three species belonging to the genus *Cercyon* (Hydrophilidæ), *Quedius capucinus* (Staphylinidæ), and most of the species belonging to the family Scarabaeidæ were present in large numbers. These forms were also collected early in the season. Species belonging to the genus *Aphodius* were the earliest to be collected from the fresh dung. A few specimens had apparently hibernated beneath an old pile of bedding. These included many of the Staphylinidæ, *Byrrhus americanus*, two species of *Aphodius*, and *Trox insularis*.

Only one generation of *Aphodius granarius* and *A. fimetarius* was reared during the summer.

Most of the Diptera collected breed in excrement, but representatives of a few families were captured which do not breed in

dung. Many of the Diptera were collected only during the latter part of May, and during June. The Diptera reared from sheep dung required from eight to twenty-nine days for their development.

LITERATURE

1929. HALL, M. C. Arthropods as Intermediate Hosts of Helminths. Smithsonian Misc. Coll., Vol. 81, No. 15 (End of Volume), pp. 1-77.
1900. HOWARD, L. O. A Contribution to the Study of the Insect Fauna of Human Excrement. Proc. Wash. Acad. Sci., Vol. 2, pp. 541-604.
1908. WILLISTON, S. W. Manual of the Families and Genera of North American Diptera. James T. Hathaway, New Haven, Third Edition.
1929. WILSON, J. W., and STOLL, N. R. Two Common Fly Species Easily Reared in the Laboratory. Science, Vol. 69, No. 1796, pp. 577-579.

JOHN POINTER'S COLLECTION OF INSECTS

BY HARRY B. WEISS

NEW BRUNSWICK, N. J.

John Pointer, Oxford graduate, author, antiquary, deacon, priest, and chaplain to Merton College from 1693 to 1722, gave his collection of coins, works of art, plants, animal skeletons, dried birds, shells, fossils, minerals, drugs, etc., to St. John's College, because as he said, "There being such a Collection of Curiosities in this College already, has induc'd me to bequeath my own Collection to be added to it, hoping it may be a Maintenance (or at least a Help towards one) for some young Scholar in shewing 'em; a Scholar to be appointed by the President, to whom he shall administer an Oath to keep all Things safe." Included in the collection were twenty-eight groups of "insects with wings" and eleven of "insects without wings."

In Pointer's descriptive "Catalogue of the Musaeum Pointerianum" (c. 1740), which Dr. R. T. Gunther has incorporated in his book "Early Science in Oxford" (Vol. III, Oxford, 1925), the list is as follows. Insects with wings—"Bees; Wasps; Hornet, or Great Wasp; Humble-bees; the Musk-fly; Flesh-fly, *Musca carnivora*; Horse-fly, *Musca Equina*; Ox-fly; Great-dragon-flies, or Water-butter Flies; Water-flies; the Gnat, *Culex*; Butterflies; the Day-Butterflies; Glow-worm, *Cicindela*; Grasshopper, *Cicada*; Cricket, *Gryllus*; the Cricket, called the Mole-cricket; Moths call'd *Blattae*; *Cantharides* or Spanish Flies; Beetles, call'd by Latins *Scarabaei*; the Bright-blew-colour'd Beetle; the Long-smooth-scarabaeus; the little Green-scarabaeus; Small-chafers; the Oyl-beetle or Water-beetle, *Proscarabaeus*; Earwig, *Auricularia* or *Fullo*; Chinese-flies; the Stag-fly, of the Beetle-kind." Insects without wings—"Silk-worms, *Bombyces*; Other Smooth Caterpillars; Hairy-caterpillars; *Staphylinus*; the *Scolopendrae*; *Millepedes*, *Aselli*, Ang. Sows or Hog-lice; Spiders, *Araneae*; Ants; a Water-worm; an Earth-worm; Snails." Each name is followed by an account, describing in

part, the appearance or habits of the species and these are so interesting and quaint that several are quoted.

“Hornet, or Great Wasp. Their Tails are arm’d with such a Venemous Sting that they will kill a Horse, *Ut ter novenis ictibus Hominem, imò Equum interficiant*, says Moufet. *Spicula Carbronum asperima*, says Virgil.”

“Humble-bees, call’d by the Germans Hummel, from the Humming noise they make, and Bees of little use, therefore the old Grecians used to call a useless Fellow.”

“The Musk-fly, a diminutive Bee yielding a strong Perfume like that of a Musk; found in Buckingham-shire. Another sort like a large Cantharides with long Horns.”

“The Gnat, *Culex*. A very mischievous little Animal, that annoys men both Day & Night, both with its shril noise & sharp Sting, especially those y^t live near Fens & Rivers. He has 2 Wings, great for y^e bigness of his Body, 6 crooked scrambling Legs, with w^{ch} he lifts up his Body wth more ease. He has a long Body, & a Proboscis 3 times longer than those of Common Flies, with a Sharp Point to break thro’ the Skin, & fistulous to suck y^e Blood. There are 3 Sorts, bigger, lesser, middlemost, & least. The Least Sort are the most stinging, here in England; but in the America they are very Large & so Stinging that they will pierce thro’ very thick cloathing. This little Insect has vast Spawn, sometimes above an inch long & $\frac{1}{2}$ a Quarter Diameter (in w^{ch} the Eggs are neatly laid.”

“The Bright-blew-colour’d Beetle; this Beetle in August is troubled with Lice hanging between its Legs, & at last kill’d by them. This may be call’d the Louzy-Beetle.”

“*Staphylinus* is another Insect w^{ch} Moufet reckons among the Caterpillars, tho’ I am rather inclin’d to think it a Beetle, both from its shape & colour, being of a shining Black, only y^e Body is slender & longer, & it commonly walks with his Tail cock’d up, especially when provok’d, & then it emits some excrement out of its Tail. Aristotle says it will poison a Horse if eaten by him: but how so small an Insect that is not so thick as ones Little Finger Shou’d poison so large a Beast, I cannot tell.”

Pointer’s interests were quite varied. In 1713 he wrote “An Account of a Roman pavement lately found at Stunsfield,

Oxfordshire'' and when it was adversely criticized, he replied by publishing testimonials. His other writings include a ''Chronological History of England,'' 1714-16; ''A Rational Account of the Weather,'' 1723; ''Roman Antiquities in Britain,'' 1724; ''Britannia Triumphans,'' 1743, dealing with naval victories over the Spanish; ''Miscellanea in usum juventutis Academicæ,'' 1718, and ''Oxoniensis Academia, or the Antiquities and Curiosities of the University of Oxford,'' 1749.

MISCELLANEOUS NOTE

Atteva punctella Cramer (*aurea* Fitch).—One specimen and two small colonies of larvæ on *Ailanthus*, observed by the writer at Pound Ridge Reservation, Westchester County, New York, August 22, 1931.

Eudiotis nitidalis Cramer.—One specimen collected at Mastic, Long Island, New York, about September 13, 1931, by D. G. Nichols.

Only one record is given for both of the above species in Smith's Insects of New Jersey, and the New York State List.—Frank E. Watson.

BOOK NOTICES

My Nature Nook, or Notes on the Natural History of the Vicinity of Dunedin, Florida. By W. S. Blatchley. Indianapolis, Indiana. The Nature Publishing Company, 1931. 302 pp. 15 pl.

When one is familiar with an author only through his descriptions of hundreds of new species of Coleoptera, Heteroptera and Orthoptera, or his writings on geology, petroleum, lime, mineral waters and clays, one is apt to think of him only impersonally in connection with such subjects. The man himself becomes rather vague, and one thinks of him as aloof from the ordinary things of life.

To students of American Coleoptera, Heteroptera and Orthoptera, to those who know Mr. Blatchley only through his great manuals on these subjects, his latest book provides them with an opportunity of meeting him personally, of going on collecting trips with him, of listening to his opinions, and of enjoying with him the screaming cry of the fish hawk, a Carolina rail taking a bath, the silvery sides of the spotted sea trout, frogs suddenly diving overboard, a lizard basking in the sunshine.

Mr. Blatchley purchased in 1913 a little tract of land just outside the town limits of Dunedin, Florida, for his winter home, and his book is concerned chiefly with the clearing of this tract, the building of his home and the natural history of the animals and plants near-by. One is introduced to the practical and hard work of cutting palmettoes all day long, to the pleasures of fishing, to the duties incidental to building a house, and then to days of leisure when Mr. Blatchley followed his own inclinations and enjoyed his pines and oaks and birds and insects and sunsets and storms. At times there is a note of sadness, but life, as we know, is not all happiness.

To read this book is to pay a long visit to Mr. Blatchley at his Florida home, to enjoy simple every-day happenings, to be contented, to be thoughtful, to be quiet, but best of all—to know Mr. Blatchley more intimately than one ever could by reading all his technical writings.—HARRY B. WEISS.

The Butterfly Book, New and Thoroughly Revised Edition. A Popular and Scientific Manual, Describing and Depicting all the Butterflies of the United States and Canada. By W. J. Holland, Ph.D., Director Emeritus of the Carnegie Museum. xii + 424 pages, 73 colored and 4 black and white plates, and numerous figures in the text, giving over two thousand representations of North American Butterflies. Doubleday, Doran & Company, Inc., Garden City, New York. 1931. Price \$10.00.

Dr. W. J. Holland, the dean of American entomologists, is now in his eighty-fourth year, and can justly feel proud of his latest accomplishment in behalf of students and collectors of North American butterflies. This new and revised edition of the *Butterfly Book* he very fittingly re-dedicates to his scientific friends throughout the world. During the thirty-three years of elapsed time, between the date of the first printing and the new edition, over sixty-five thousand copies were sold. This is an index of its usefulness and popularity. It is safe to say that no other book in this country has induced more people to take up Lepidoptera as a hobby, or has been of greater help to the beginner in this field.

The general appearance and arrangement of the new edition is essentially the same as that of the old one. Although containing a great amount of new text, twenty-nine additional plates and fifteen more text figures, it is but little larger than the old work. This is due to the wider page and slightly reduced margins, allowing considerable more text to the page. The larger page of text has, in general, allowed a better arrangement of text figures. For example, the antennæ of butterflies and moths, figures 77 and 78, are together, on one page (47), and may be compared at a glance. In the old work, the plates were scattered through the book. They have now been placed in the back, which is a decided improvement, as they may be more readily studied. The original 48 plates are retained. The new plates, numbers 49 to 77, inclusive, illustrate the species and varieties omitted from the old work, and those described since its issue in 1898. All of the plates, with one or two exceptions, are excellent, which is rather remarkable when the great number of printings that were made from the original set are considered.

Much of the introductory text remains but little changed. Chapter III, on classification, has the number of orders of in-

sects brought up to date, there being twenty-two: the old work having given eleven. The number of families of butterflies has been increased from five to seven. Chapter IV, "Books about North American Butterflies," has been considerably improved, enlarged, and brought up to date, and should be of great help to the beginner.

The taxonomic, or main body of the book has been greatly changed and enlarged. The additional text includes the species and varieties omitted from the first edition, those described since its publication, and several new species and varieties described here for the first time. Also one new subfamily is proposed (page 244). The changes consist in revising the taxonomy, in the use of subgenera, and group names. There will probably be some difference of opinion in the use of these. However, the breaking up of the large genera into groups, may be of assistance to the amateur in arranging his collection. As an example of the generic and subgeneric treatment, the "Blues" are all placed in the genus *Lycæna*, and this genus is subdivided by subgeneric headings in the text. To illustrate the point, see page 268, where *Lycæna sonorensis* Felder is placed in the subgenus *Philotes* Scudder. These subgenera are, for the most part, the genera of the latest check lists.

Dr. Holland's treatment of genera is very conservative, and old familiar names of long usage have been retained whenever possible. These and other nomenclatorial matters have been discussed at length in several of his papers published in the *Annals of the Carnegie Museum*.

There will doubtless be some criticism of Dr. Holland's lack of subspecific usage throughout the work. Subspecific reference is rarely resorted to, the subspecies of the latest revisions and check lists being treated, for the most part, as species or varieties. The simpler names will be easier for the tyro, and Dr. Holland no doubt had this in mind when rewriting the text.

The reader by referring to the explanation of plates will note that a large proportion of the species and varieties are figured from types and paratypes. This is perhaps the most important and outstanding improvement in the new work. Types were, of course, figured in the old edition, but were not designated.

The production of this new edition has been an enormous task, and has entailed a great amount of very hard labor. The writer wishes to call the reader's attention to the painstaking work and research of Dr. Holland, who visited the various museums to study their types and other material, and to discuss the involved taxonomic problems with the curators. These visits from Dr. Holland were not only pleasant and stimulating but have given us a personal interest in the Butterfly Book.—FRANK E. WATSON, American Museum of Natural History, New York, N. Y.

**REVIEW OF THE THIRD EDITION OF SANDERSON'S
AND PEAIRS' "INSECT PESTS OF FARM,
GARDEN AND ORCHARD"**

BY J. S. WADE

Insect Pests of Farm, Garden and Orchard. By E. Dwight Sanderson. Third Edition, revised and enlarged by Leonard Marion Peairs. New York, John Wiley & Sons, Inc., octavo, 568 pp., 607 figs., 1931. \$4.50.

It is a significant indication of the practical value of the results obtained by present-day workers in economic entomology that the standard books on the subject require revision at quite frequent intervals. It is always of interest to compare the latest with earlier revisions that one may note the extent of progress which investigators have made during a given period. This is particularly true in the case of the well-known volume under consideration, for it has had an interesting and an honored history and has been a valued and much used tool in very nearly every entomological workshop.

It was as early as 1902 that Professor E. Dwight Sanderson, realizing that the information most frequently needed on control of many of our greatest insect pests was quite widely scattered through such original sources as the publications of the U. S. Department of Agriculture, the various State experiment stations, and books on economic entomology, undertook to assemble data most needed in a convenient and readily accessible compilation. This little 12mo. volume comprised only 295 pages and 162 figures and bore the title "Insects Injurious to Staple

Crops." The work proved to be so useful and so popular that after a ten-year interval the publishers, in issuing a new edition, requested a revision. It was found, however, that the advances in economic entomology during the entire interval had been so great that it was necessary practically to rewrite the book. The project was developed into a volume issued in 1912, bearing the title "Insect Pests of Farm, Garden and Orchard." This work, too, proved to be of unusual excellence, and it was necessary to issue in 1921 a second edition, 12mo., 707 pages, 604 figures, revised and enlarged by Dr. Leonard Marion Peairs. The scope of such a compilation may be realized when it is noted that all the leading authorities on the subjects under consideration were consulted and the compilers endeavored to evaluate and to present their evidence with such interpretation as their personal knowledge made possible.

It is with a deep feeling of personal gratitude that the reviewer acknowledges his personal indebtedness to these two editions. The data included were presented in such compact and accessible form as to render them not only suitable for office correspondence and laboratory use, but were also readily portable and hence available while the reviewer was in travel status. Through courtesy of the publisher it is, therefore, with especial pleasure that this review is undertaken.

Concerning this new edition the authors modestly state that they "fully realize that a book of this nature begins to be out of date the day it is published and becomes more so each day." "However, a student with an inquiring mind will readily see that Economic Entomology is a living subject and that it presents unsolved problems which invite investigation." In the present edition only a few of the original articles of the first edition by Doctor Sanderson remain more or less intact. It, however, has been almost entirely rewritten by Doctor Peairs and much new material and many new illustrations have been included, and the entire volume reset to a larger size page. The various subdivisions of the book include treatment of such topics as estimates in dollars of injury to crops by insect pests; structure and development of insects; general, cultural, mechanical, biological and chemical methods and apparatus on insect con-

trol; insects affecting miscellaneous garden, grain and forage crops, grasses and grains, clovers and alfalfa, beans, peas, cruciferous and solanaceous crops, cucurbits, beets and miscellaneous garden crops, pests of southern field crops—cotton, tobacco, sugar-cane and rice. The matter on fruit insects includes treatment of those generally injurious in the orchard and specifically those destructive to apple and pear, stone fruits, grapes, small fruits, and citrus fruits. There are chapters dealing with the pests injurious to stored grains, foods and fabrics, as well as those affecting livestock, poultry and mankind. An excellent, thoroughly workable index is appended. One of the features of special value in this, as in previous editions, is the generous citation page by page of references to latest literature on the particular topic under discussion.

It is illuminating to compare sections of this third edition page by page with the first and second editions if one merely notes some of the more outstanding additions in recent years. These include discussion of such topics as insecticides, notably calcium arsenate and magnesium arsenate, or latest developments in control of insect pests such as European corn borer, Mexican bean beetle, sweet potato weevil, Mexican cotton boll-weevil, pink boll-worm, Japanese beetle, Oriental fruit moth, or Mediterranean fruit fly. On the whole this third edition appears fully up to the high standard of its predecessors and the authors are to be congratulated upon work well done and well worth while.

The New York Entomological Society

Organized June 29, 1892—Incorporated June 7, 1893

The meetings of the Society are held on the first and third Tuesday of each month (except June, July, August and September) at 8 P. M., in the AMERICAN MUSEUM OF NATURAL HISTORY, 77th Street and Columbus Avenue.

Annual dues for Active Members, \$3.00; including subscription to the Journal, \$4.50. Members of the Society will please remit their annual dues, payable in January, to the treasurer.

Officers for the Year 1932

President, ANDREW J. MUTCHLER.....American Museum of Natural History, N. Y.
Vice-President, ERNEST L. BELL.....150-17 Roosevelt Ave., Flushing, Long Island
Secretary, ELIZABETH SHERMAN.....132 Primrose Ave., Mt. Vernon, N. Y.
Treasurer, GAYLORD C. HALL.....144 E. 22nd St., New York
Librarian, FRANK E. WATSON.....American Museum of Natural History, New York
Curator, A. J. MUTCHLER.....American Museum of Natural History, New York

EXECUTIVE COMMITTEE

WM. T. DAVIS DR. WM. MOORE HERBERT F. SCHWARZ,
HOWARD NOTMAN, HENRY BIRD.

PUBLICATION COMMITTEE

HARRY B. WEISS, CHARLES W. LENG JOHN D. SHERMAN, JR.,
C. E. OLSEN.

PROGRAM COMMITTEE

C. H. CURRAN HARRY B. WEISS, J. L. HORSFALL

AUDITING COMMITTEE

E. L. BELL, DR. E. K. SCHWARZ, DR. E. R. P. JANVRIN.

FIELD COMMITTEE

A. S. NICOLAY, MRS. A. S. NICOLAY

DELEGATE TO THE N. Y. ACADEMY OF SCIENCES

WILLIAM T. DAVIS

JOURNAL

of the

NEW YORK ENTOMOLOGICAL SOCIETY

Published quarterly by the Society at Lime and Green Sts., Lancaster, Pa. All communications relating to the Journal should be sent to the Publication Committee, New York Entomological Society, American Museum of Natural History, New York City; all subscriptions to Lime and Green Sts., Lancaster, Pa., or to the Treasurer, Gaylord C. Hall, 144 E. 22nd St., New York City, and all books and pamphlets to the Librarian, Frank E. Watson, American Museum of Natural History, New York City. Terms for subscription, \$3.00 per year, strictly in advance. *Please make all checks, money-orders, or drafts payable to New York Entomological Society.*

Twenty-five reprints without covers are furnished free to authors. Additional copies may be purchased at the following rates:

	4 pp.	8 pp.	12 pp.	16 pp.	24 pp.	32 pp.
25 copies	\$2.40	\$5.22	\$5.58	\$5.58	\$9.00	\$9.60
Additional 100's .....	.60	1.44	1.92	1.92	3.00	3.00
Covers	50 copies, \$2.50; additional 100's, \$1.50.					

Half-tone prints 1½ cents for each half-tone print.

Authors whose papers are illustrated with text figures or full page plates will be required to supply the electrotypes or pay the cost of making the same by the Journal and also to pay the cost of printing full page plates on coated paper, when advisable.

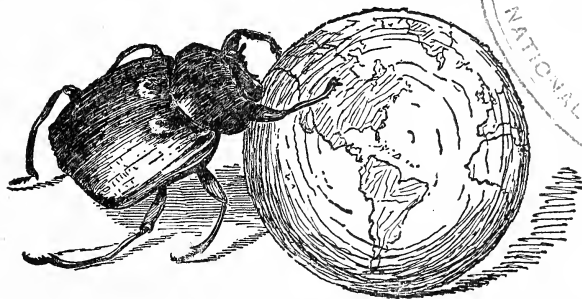
VOL. XL

JUNE, 1932

No. 2

JOURNAL
OF THE
NEW YORK
ENTOMOLOGICAL SOCIETY

Devoted to Entomology in General



JUNE, 1932

Edited by HARRY B. WEISS

Publication Committee

HARRY B. WEISS

CHARLES W. LENG
C. E. OLSEN

J. D. SHERMAN, JR.

Published Quarterly by the Society

LIME AND GREEN STS.
LANCASTER, PA.
NEW YORK, N. Y.

1932

Entered as second class matter July 7, 1925, at the post office at Lancaster, Pa., under the Act of August 24, 1912.

Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized March 27, 1924.

Subscription \$3.00 per Year.

CONTENTS

The North American Species of the Genus <i>Limnophora</i> Robineau-Desvoidy, with Descriptions of New Species (Muscidae, Diptera). By H. C. HUCKETT	105
Are Economic Entomologists Becoming "Insecticide Minded?" By ALVAH PETERSON	159
An Occurrence of Spiral Segmentation in <i>Apentesis Nais</i> (Lep., Arct.). By E. T. LEARNED	167
New North American Scarabaeidae, with Remarks on Known Species. By H. C. FALL	183
The Membracidae of Africa. By FREDERIC W. GODING	205
Additional Records of North American Cicadas with De- scriptions of New Species. By WM. T. DAVIS	241
Proceedings of the New York Entomological Society	267
NOTICE: VOLUME XL, NUMBER 1, OF THE JOURNAL OF THE NEW YORK ENTOMOLOGICAL SOCIETY WAS PUBLISHED ON MARCH 15, 1932.	

JOURNAL

OF THE

New York Entomological Society

VOL. XL

JUNE, 1932

No. 2

THE NORTH AMERICAN SPECIES OF THE GENUS LIMNOPHORA ROBINEAU-DESVOIDY, WITH DESCRIPTIONS OF NEW SPECIES (MUSCIDÆ, DIPTERA)

(Continued from page 76)

BY H. C. HUCKETT

RIVERHEAD, N. Y.

Limnophora (Spilogona) narina (Walker)

Anthomyia narina Walker, List Dipt. Brit. Museum, 1849 IV p. 933.—Walker, Canad. Ent., 1871 III p. 144.—Osten Sacken, Misc. Coll. Smithsn. Inst., 1878 III p. 169.

Spilogaster narina Stein, Zeitschr. f. Hymen. u. Dipt., 1901, I Heft 4 p. 202.—Aldrich, Misc. Coll. Smithsn. Inst., 1905 XLVI No. 1444 p. 545.

Paralimnophora brunnesquama Malloch, Proc. U. S. Nat. Mus., 1913 XLV No. 2004 p. 605.

Limnophora nigrifrons Stein, Arch. f. Naturgesch., 1920 May (1918) Abt. A Heft 9 p. 49.

Limnophora narina Stein, Arch. f. Naturgesch., 1920 May (1918) Abt. A Heft 9 p. 57.

Limnophora velutina Malloch, Proc. Amer. Ent. Soc., 1920 June XLVI No. 802 p. 147.

Melanochelia velutina Malloch, Canad. Ent., 1921 LIII p. 62.

Paralimnophora velutina Johnson, Occ. Pap. Boston Soc. Nat. Hist., No. VII 1925 p. 230.—Johnson, Insect Fauna Biol. Surv. Mt. Desert Region, 1927 p. 208.

JUL 7 1932

Spilogona velutina Hockett, Mem. 101 N. Y. (Cornell) Agric. Exp. Station, 1928 (1926) p. 834.

RECORDS:—

Quebec, 1 ♂, Hemmingford, June 21, 1925; 1 ♀, July 25, 1925; 1 ♂, July 10, 1925. (G. H. Hammond) 2 ♂, Hemmingford, June 20, 1922; 1 ♂, June 26, 1922; 2 ♂, June 28, 1922. (C. E. Petch) 2 ♀, Hemmingford, June 29, 1922; 1 ♀, July 30, 1923. (A. D. Baker) 2 ♀, Covey Hill, June 25, 1927. (W. J. Brown)

Ontario, 1 ♂, Ottawa, June 19, 1914. (J. I. Beaulne) 1 ♂, 1 ♀, Waubamick, June 15 —; 1 ♀, Coniston, July 27 —. (H. S. Parish)

New Brunswick, 1 ♂, St. John's, June 23, 1901. (W. McIntosh) 3 ♀, Gornish, July 11, 1913.

Nova Scotia, 1 ♂, Truro, July 13, 1913; 1 ♂, July 16, 1913. (R. Matheson)

New Hampshire, 1 ♂, Base Mt. Washington, 2600 ft. (Fls. *Anaphalis*) Aug. 25, 1914. (C. H. T. Townsend)

Vermont, 2 ♀, Lynden, June 13, 1914. (A. L. Melander)

New York, 1 ♂, 1 ♀, Ringwood, Ithaca, June 13, 1922; 1 ♀, July 13, 1920; 1 ♂, McLean, Tompkins Co., July 9, 1921. (L. S. West) 1 ♀, Caroline-Harford, June 15, 1904; 1 ♀, Slaterville, Aug. 15, 1921; 1 ♂, Ithaca, July 19, 1920; 1 ♀, June 5, 1915.

Montana, 1 ♀, Bozeman, July 27, 1916. (Mont. Agric. Exp. Sta.)

British Columbia, 1 ♂, Rolla, July 23, 1927; 1 ♀, July 11, 1927. (P. N. Vroom)

The species is readily recognized on account of its characteristic appearance: in the male the eyes are as widely separated as in the female, the vertical and ocellar bristles are robust, being about equal in size to the first pair of dorsocentral bristles, and the calyptre are entirely blackish brown. The female differs markedly from the male in that the thorax is pale yellowish gray and the abdomen ochreous, both without any markings; the calyptre are whitish.

Specimens were sent to Mr. J. E. Collin, who made the necessary comparisons with Walker's type, a female, in the British Museum.

Limnophora (Spilogona) subrostrata Stein

Limnophora subrostrata Stein, Arch. f. Naturgesch., 1920 (1918)
Abt. A Heft 9 p. 54.

RECORDS:—

Alaska, 1 ♂, Katmai, 1917. (J. S. Hine)

British Columbia, 1 ♂, 2 ♀, Carbonate to Prairie Hills, July 12–18, 1908. (J. C. Bradley) 1 ♂, 7 ♀, Revelstoke Mountain, 6000 ft. Aug. 12, 1923. (E. R. Buckell) 1 ♂, London Hill Mine, Bear Lake, 7000 ft. July 28, 1903. (R. P. Currie)

Alberta, 1 ♂, Banff, July 19, 1922. (C. B. D. Garrett)

Washington, 1 ♂, 6 ♀, Paradise Park, Mt. Rainier, Aug. 1917; 1 ♂, 1 ♀, Squaw Lake, Mt. Rainier, Aug. 8, 1922; 1 ♂, 1 ♀, Ind. Henry, Mt. Rainier, Aug. 2, 1922; 1 ♂, Ararat Mt., Mt. Rainier, Aug. 5, 1922; 1 ♂, Crystal Mt., Mt. Rainier, Aug. 3, 1922. (A. L. Melander).

Colorado, 3 ♀, Long's Peak Trail, above timber line, July 20 —. (Cockerell)

The species was described from specimens collected by Dr. J. C. Bradley in British Columbia of which the above British Columbia specimens are at least representatives of the original series sent to Stein for determination. The species very closely resembles another from British Columbia, *sectata* (p. 112), differing in that the oral margin of *subrostrata* is slightly protruded beyond a level with base of antennæ and the calyptræ are whitish. In the female such differences are less apparent.

Limnophora (Spilogona) hyperborea (Boheman)

Aricia hyperborea Boheman, Öfversigt Kongl. Vetens. Akad. Förhandling., 1865 XXII p. 571.

?*Aricia labiosa* Boheman, Öfversigt Kongl. Vetens. Akad. Förhandling., 1865 XXII p. 571.

?*Aricia megastoma* Boheman in part, Öfversigt Kongl. Vetens. Akad. Förhandling., 1865 XXII p. 572.

Aricia dorsata Holmgren not Zetterstedt, Kongl. Svensk. Vetens. Akad. Handling., 1869 VIII No. 5 p. 29.—Holmgren, Öfversigt Kongl. Vetens. Akad. Förhandling., 1873 (1872) No. 6 p. 101.—Holmgren, Ent. Tidskr., 1883 IV p. 167.—Osten Sacken, Misc. Coll. Smithsn. Inst., 1878 III p. 164.

- Aricia fuliginosa* Holmgren, Kongl. Svensk. Vetens. Akad. Handlung., 1869 VIII No. 5 p. 30.
- Aricia conspurcata* Holmgren, Kongl. Svensk. Vetens. Akad. Handlung., 1869 VIII No. 5 p. 31.
- Aricia illota* Holmgren, Kongl. Svensk. Vetens. Akad. Handlung., 1869 VIII No. 5 p. 32.
- Limnophora conspurcata* Stein, Wien Ent. Zeitg., 1902 XXI p. 57.—Stein, Katal. Paläark. Dipt., 1907 III p. 670.
- Limnophora fuliginosa* Stein, Wien Ent. Zeitg., 1902 XXI p. 59.—Stein Katal. Paläark. Dipt., 1907 III p. 671.
- Limnophora illota* Stein, Wien Ent. Zeitg., 1902 XXI p. 59.—Stein, Katal. Paläark. Dipt., 1907 III p. 671.
- Hyetodesia dorsata* Aldrich not Zetterstedt, Misc. Coll. Smithsn. Inst., 1905 XLVI No. 1444 p. 541.
- Limnophora frigida* Ringdahl, Ent. Tidskr., 1920 XLI p. 27.
- Limnophora pearyi* Malloch, Trans. Amer. Ent. Soc., 1920 XLVI No. 802 p. 151.
- Melanochelia pearyi* Malloch, Canad. Ent., 1921 LIII p. 63.
- Limnophora hyperborea* Collin, Ann. Mag. Nat. Hist., 1923 ser. 9 XI p. 117.—Collin, Ann. Mag. Nat. Hist., 1924 ser. 9 XIV p. 201.—Collin, Ann. Mag. Nat. Hist., 1925 ser. 9 XVI p. 336.
- Limnophora (Spilogona) hyperborea* Collin, Trans. Ent. Soc. London, 1930 LXXVIII Pt. 2 p. 265.—Collin, Ann. Mag. Nat. Hist., 1931 ser. 10 VII p. 83.

RECORD:—

1 ♂, Nettilling Lake, Baffin Land, July 9, 1925. (J. D. Soper)
This species was described from Spitzbergen by Boheman (4), and is listed by Holmgren (15) under the name *dorsata* Zetterstedt as occurring in Greenland. This error in identification lead to the recording of *dorsata* as a North American species in the catalogues of Osten Sacken (36) and Aldrich (1). So far as I know the true *dorsata* has not yet been recognized as occurring in North America.

The above specimen from Baffin Land was submitted to Mr. J. E. Collin for identification, who reported that for *hyperborea* the specimen was very small and not typical except for the genitalia. I have quoted the synonymy given by Collin (6.6a). Holmgren (15) and Stein (56) have both regarded *hyperborea* as a synonym of *dorsata* Zetterstedt.

An examination of the type and allotype of *pearyi* Malloch revealed that there were no tangible differences between these specimens and those of *hyperborea* from Sweden, the latter being kindly furnished by Mr. Ringdahl. The male paratype of *pearyi* in the collection of the Illinois State Natural History Survey is in my opinion another species, differing essentially from the type in having a series of short bristles on proximal half of postero-ventral surface of hind femur, in lacking the median ventral bristle on mid tibia, and in not having the oral margin protruded beyond a level with base of antennæ.

The species keys to the same couplet with *subrostrata* from which it may be separated in both sexes by the possession of a few setulose hairs on dorsal margin of lateral declivities of scutellum adjacent the apical bristles, the sternopleural bristles are arranged in the order 1 : 2, and not 1 : 1. In the male the halteres are black, whereas in *subrostrata* they are yellow.

Limnophora (Spilogona) obsoleta Malloch

Limnophora obsoleta Malloch, Trans. Amer. Ent. Soc., 1920 XLVI No. 802 p. 149.—Frison, Bull. Ill. Nat. Hist. Surv., 1927 XVI Art. 4 p. 203.

Melanochelia obsoleta Malloch, Canad. Ent., 1921 LIII p. 62.

Melanochelia hirticauda Malloch, Proc. Cal. Acad. Sci., 1921 4th ser. XII p. 181.

Limnophora (Spilogona) obsoleta Collin, Trans. Ent. Soc. London, 1930 LXXVIII Pt. 2 p. 271.

RECORDS:—

Alaska, 1 ♂, St. Paul Island, July 12, 1920; 1 ♀, Aug. 10, 1920.

(G. D. Hanna) 1 ♂, 1 ♀, Savonoski, Naknek Lake, June 1919; 1 ♀, July 1919. (J. S. Hine) 1 ♀, Point Barrow, June 22, 1882. (John Murdock)

The species was described from Greenland. Later Malloch had the same species before him when he described *hirticauda* from St. Paul Island, Alaska, as indicated by a comparison of paratypes of *hirticauda* with the type of *obsoleta*. The species may be readily recognized by the abnormally small calyptræ. In this respect the species resembles the following, *melanosoma* (p. 110), the calyptræ of which are slightly larger. In addition,

both species possess one or more mid ventral bristles on mid tibia, the abdomen is uniformly deep seal brown in color, with no markings, and the face is noticeably blackened. However *obsoleta* may be distinguished from *melanosoma* through the possession of a series of short bristles on posteroventral surface of hind femur.

***Limnophora (Spilogona) melanosoma* new species**

MALE, blackish; head with grayish pruinescence on parafrontals and parafacials; cheeks and face of darker contrasting shade, the former velvety with brownish sheen, the latter blackish: antennæ and palpi blackish; proboscis pollinose. Thorax and abdomen largely blackish, concolorous; mesonotum with trace of pruinescence; humeral callosity grayish pruinose. Legs black, pulvilli brownish tinged. Wings slightly infuscated, more noticeably so on the membrane adjoining the veins, darker basad. Calyptre tinged with yellow: halteres brownish black.

Head with eyes separated by a distance equal to that between posterior ocelli; frontal vitta entire, narrowed caudad, distinctly separating the parafrontals; parafrontal bristles extended in series caudad to nearly a level with the anterior ocellus: parafacials at base of antennæ about as wide as average breadth of third antennal segment, but little narrowed ventrad: cheeks in height nearly equal to length of third antennal segment, the latter about one and a half times as long as broad.

Thorax with acrosticals setulose, the presutural setulæ in two irregularly paired series; with four pairs of postsutural dorsocentral bristles; scutellum with a few setulose hairs on dorsal margin of lateral declivities adjacent apical bristles: sternopleural bristles, 1: 1.

Abdomen subcylindrical, marginal and discal bristles of terga finely developed; basal sclerite of hypopygium with numerous erect bristles: processes of fifth sternum with a few fine bristles on distal half and having a small polished apical callosity on inner margin.

Fore tibia with no median posterior bristle: mid femur with a series of posteroventral bristles on proximal half; mid tibia with no anterodorsal bristle, with 2 or 3 posterior and 2 or 3 posteroventral to ventral bristles: hind femur with 5 or 6 anteroventral bristles on distal half; with no bristles on posteroventral surface; hind tibia with 2 to 4 anteroventral, 2 or 3 anterodorsal bristles, and 2 or 3 weaker posterior bristles. Costa with a distinctive series of short setulæ.

FEMALE, paler than male: head with parafrontals, parafacials, and cheeks brownish pruinose, the latter with dark reflections: mesonotum largely brownish infuscated, with three more or less distinctive vittæ, the sublaterals broader than and not as well defined as the dorsocentral vitta; scutellum with brownish marks laterad at basal angles; mesopleura largely brownish infuscated: abdomen grayish, subshining, with trace of ill-defined brownish

markings on terga 3, 4 and 5: wings clear or as in male; calyptre yellowish; halteres yellow.

Head with parafrontals setulose; parafacials and cheeks much higher than breadth of third antennal segment, with numerous setulae along the ventral half of facial margin. Abdomen with marginal and discal bristles stronger developed: ovipositor with spinules on anal plates. Fore tibia with or without a median posterior bristle: mid tibia with 1 or 2 anterodorsal, 2 or 3 posterodorsal, 1 posterventral, and 2 or 3 ventral bristles: hind legs similar to male: costa with a series of prominent setulae.

Length 5.5 mm.

RECORDS:—

1 ♂, 2 ♀, Naknek Lake, Savonoski, Alaska, July, 1919; 2 ♀, August 1, 1919; 1 ♂, Katmai, Alaska, July, 1917. (J. S. Hine) Type and allotype in the collection of Professor J. S. Hine, Columbus, Ohio.

This species closely resembles *obsoleta*, but may be distinguished in both sexes from the latter by the lack of bristles on the proximal half of posteroventral surface of hind femur, the shorter setulae on costa of wing, and by the slightly larger size of the lower scale of calyptre.

Limnophora (*Spilogona*) *novæ-angliæ* Malloch

Limnophora novæ-angliæ Malloch, Trans. Amer. Ent. Soc., 1920 XLVI No. 802 p. 151.

Melanochelia novæ-angliæ Malloch, Canad. Ent. 1921 LIII p. 62.

Spilogona novæ-angliæ Malloch, Psyche, 1924 XXXI No. 5 p. 201.—Johnson, Occ. Pap. Boston Soc. Nat. Hist. No. VII., 1925 p. 229.

RECORDS:—

Quebec, 1 ♀, Kazubazua, June 6–10, 1927. (W. J. Brown)

Ontario, 1 ♀, Kearney, June 20, 1926; 1 ♂, Sand Lake, July 1, 1926. (F. P. Ide)

New Brunswick, 1 ♂, Fredericton, June 15, 1920, on fir. (R. P. Gorham)

Maine, 1 ♂, S. W. Harbor, Sept. 6, 1922. (C. W. Johnson)

New Hampshire, 1 ♀, base Mt. Washington, 2600 ft. Aug. 22, 1914; 2 ♂, Bretton Woods, 2000 ft. Aug. 23, 1914. (C. H. Townsend)

British Columbia, 1 ♀, Hedley, 7000 ft. July 23, 1923. (C. B. D. Garrett) 1 ♀, Grouse Mt. Vancouver, Sept. 3, 1926. (J. Stanley)

Alaska, 1 ♂, Katmai, July, 1917; 1 ♀, Naknek Lake, Savonoski, Aug. 1, 1919; 1 ♀, Aug. 14, 1919. (J. S. Hine)

The species was described from Maine and Labrador, and evidently occurs throughout the Canadian life zone extending West to British Columbia and Alaska. Malloch (31) has compared the species to *brunneisquama* Zett., from which it may be readily separated by the presence of longish bristles on proximal half of posteroventral surface of hind femur. Stein (60) has recorded *brunneisquama* (= *armipes* Stein) as occurring in North America, but, in my opinion, the record should be verified by an examination of the specimens before being accepted.

The species is most closely related to the following, *sectata*, the males of both species having the characteristic yellowish calyptræ, the deeply incised fifth sternum, and similar bristling on the mid tibia. In the above series of specimens all the females and only one male possess a strong median ventral bristle on mid tibia in addition to the robust median posteroventral bristle. In the females the second, third, and fourth segments of fore tarsi are noticeably broadened in contrast to the cylindrical shape of the first segment.

***Limnophora (Spilogona) sectata* new species**

MALE, blackish: head with parafrontals, parafacials, and cheeks grayish pruinose with dark reflections; frontal vitta black, opaque; antennæ and palpi black; frontal triangle and proboscis polished. Thorax blackish, subshining; mesonotum with trace of brownish pruinescence; presutural area with median vitta; scutellum entirely black. Abdomen largely blackish, subshining, with grayish pruinose areas restricted to cephalolateral angles of terga, 3, 4, 5, into which the tergal markings become more or less merged; terga 1+2 entirely blackish, terga 3, 4 and 5 with expansive black markings; basal sclerites of hypopygium blackened, shining. Legs black, pulvilli yellowish brown. Wings infuscated, blackened basad. Calyptræ intensively yellowish: halteres deep yellow.

Head with eyes separated by a distance about equal to that between posterior ocelli exclusive; frontal vitta reduced to lineal proportions caudad, barely separating the parafrontals: parafacials at base of antennæ not as broad as width of third antennal segment: cheeks equal in height to breadth of third antennal segment, with a series of short upturned bristles along

the ventral margin: antennæ small, third segment slightly longer than second; arista with minute pubescence.

Thorax with presutural acrosticals setulose; with four pairs of postsutural dorsocentral bristles; sternopleural bristles, 1: 1.

Abdomen conical, markings expansive, ill-defined and reaching to ventral regions of terga, those on tergum 3 trapezoidal and obscurely divided at middle, those on tergum 4 subtriangular, smaller, and more distinctly divided at middle, those on tergum 5 reduced; sterna 2 and 3 broader than long, sternum 5 deeply incised, with a few short setulæ and fine bristles laterad.

Fore tibia with no median posterior bristle; mid femur with a series of 5 or 6 bristles on proximal half of posteroventral surface; mid tibia with 1 anterodorsal, 1 or 2 posterior, 1 median posteroventral, and in addition 2 short median ventral bristles; hind legs missing (compare those of female). Wings with costal thorn inconspicuous, with veins *R.* 4+5 and *M.* 1+2 slightly divergent toward wing margin. Length, 5.5 mm.

FEMALE, paler than male, otherwise similar; frontal vitta deep black; frontal triangle brownish pruinose; thorax densely grayish pruinose with brownish markings; mesonotum with a median vitta and irregular markings laterad; scutellum with brownish spots at basal angles; abdomen grayish pruinose, subshining, with large brownish markings on terga 1+2, 3, and 4, and a median vitta on tergum 5. Wings clear, with trace of yellowish tinge basad; veins yellowish brown, becoming paler basad: *r-m* and *m-cu* cross veins clouded obscurely.

Eyes separated by a distance slightly greater than one third the maximum width of head; parafrontals with short irregularly developed bristles; para-facials at base of antennæ as wide as breadth of third antennal segment. Abdomen with bristles weakly developed; ovipositor with setulose hairs on anal plates; sternum 3 longer than greatest width; abdominal markings subtriangular, extending to ventral region of terga.

Fore tibia with no median posterior bristle; mid femur with 4 or 5 bristles on proximal half of posteroventral surface; mid tibia with 1 anterodorsal, 1 or 2 posterior, and 2 or 3 bristles on ventral surface which vary in their position from antero- to posteroventral; hind femur with 4 or 5 bristles on distal half of anteroventral surface, with no series of longish setulose bristles on posteroventral surface; hind tibia with 2 or 3 anteroventral, 2 anterodorsal, and 2 weaker posterodorsal bristles; fore tarsi with segments 2 to 4 cylindrical, normal in appearance. Wings with *R.* 4+5 and *M.* 1+2 divergent toward wing margin.

Length, 6.5 mm.

RECORDS:—

- 1 ♂, Hedley, B. C., July 3, 1923; 1 ♀, July 9, 1923; 1 ♀, July 19, 1923; 1 ♂, 1 ♀, 7000 ft. July 24, 1923; 1 ♀, Banff, Alta., July 18, 1922. (C. B. D. Garrett)

Type and allotype in the Canadian National Collection. Ottawa.

The species resembles most closely the European species *brunneisquama* Zett. Specimens have been forwarded to Mr. O. Ringdahl for identification, and he considers that the species is not *brunneisquama*, in support of which he has sent me specimens of the latter species for further comparison. I find that the males of *sectata* differ essentially from those of *brunneisquama* in the markings of the abdomen and armature of mid tibia. In the former species the terga are largely blackish, with broad expansive markings which extend laterad to ventral aspect of terga, and the mid tibia has on the ventral surface two mid ventral bristles and a more prominent bristle situated on posteroventral surface, whereas in *brunneisquama* terga three, four, and five are largely grayish pruinose with markings restricted to dorsum and more definite in outline, the mid tibia lacks the mid ventral bristles but possesses a stout bristle on posteroventral surface. The female of *sectata* has the abdominal markings more expansive than in *brunneisquama*, and the fore tibia has no median posterior bristle, whereas in the specimen of *brunneisquama* before me the fore tibia has a median posterior bristle and in addition a median ventral bristle. Both species, in common with *novæ-angliæ*, have the calyptre intensively yellowish, and in the females the mid tibia possesses a stout median ventral bristle. The species *novæ-angliæ* resembles *brunneisquama* in the markings of the abdomen, and to that extent differs from *sectata*. However in *novæ-angliæ* the hind femur possesses a series of longish fine bristles on proximal half of posteroventral surface, which series is lacking in both *sectata* and *brunneisquama*.

It is quite possible that this is the same species recorded by Stein (60) as *armipes*. His specimens were captured on Mt. Rainier, Washington.

***Limnophora* (*Spilogona*) *monacantha* Collin**

Limnophora (*Spilogona*) *monacantha* Collin, Trans. Ent. Soc. London, 1930 LXXVIII Pt. 2 p. 271.

RECORDS:—

- 1 ♂, Umanak, Greenland, July 26, 1914; 1 ♀, July 26, 1914.
(Crocker Land Exp., M. C. T. & W. E. E.)

The species is related to those forms with one stout spine at base of ventral surface of mid femur. The male of the species may be separated from those of allied forms in that the processes of fifth abdominal sternum are highly polished at apex, and the halteres are blackish. From *semiglobosa*, which it most closely resembles, it may be further distinguished by the pale bluish gray color of the mesonotum.

***Limnophora (Spilogona) sospita* new species**

MALE, blackish; frontal vitta deep velvety black; parafacials and cheeks grayish pruinose with brownish sheen; antennæ and palpi black; proboscis polished. Thorax with five broad brownish vittæ on mesonotum; scutellum largely blackish, the apical area obscurely paler, pruinose. Abdomen largely brownish black on dorsum, paler on venter, opaque; tergum four with darker areas divided more or less obscurely at middle; basal sclerite of hypopygium blackish; fifth sternum slightly shining. Legs black, pulvilli brownish tinged. Wings uniformly tinged, with very little deeper infuscation basad; cross veins *r-m* and *m-cu* clouded; calyptræ slightly yellowish; halteres deep yellow.

Head with eyes separated by a distance at least equal to breadth of third antennal segment; frontal vitta prominent, entire, narrowing caudad. Parafrontal bristles continued in series caudad to nearly a level with anterior ocellus; parafrontals with a few setulæ; parafacials at base of antennæ equal in breadth to that of third antennal segment, but little narrowed ventrad; cheeks broad, equal in height to length of third antennal segment, the latter about one and one-third times as long as second segment; proboscis polished.

Thorax with acrosticals setulose, with four pairs of postsutural dorso-central bristles; scutellum with no setulose hairs on dorsal margin of lateral declivities; sternopleural bristles arranged in the order 1: 2.

Abdomen subcylindrical, discal and marginal bristles decidedly stouter developed than setulæ; basal sclerite of hypopygium with numerous bristles; sternum 5 broadly incised, the lateral processes broadly truncated distad, with a small polished tubercular projection at apex of inner margin, the inner margin with a series of fine sparsely set hairs, remainder of fifth sternum sparsely setulose, with a few short bristles on distal half of processes.

Fore tibia with no median posterior bristle, with or without a weak median anterodorsal bristle: mid femur with 1 strong bristle at base of ventral surface, the antero- and posteroventral surfaces devoid of bristles on proximal half; mid tibia with 1 or 2 anterodorsal and 2 posterior bristles: hind femur with 3 to 5 anteroventral bristles on distal half, the posteroventral surface with no series of bristles; hind tibia with 2 to 5 anteroventral, and 2 or 3 anterodorsal bristles, and 1 or 2 setulose bristles on postero-

dorsal surface. Tarsi slender, much longer than their respective tibiae. Costa with a series of prominent setulae, those adjacent costal thorn longer than the remainder; *m-cu* cross vein erect.

FEMALE, similar to male; parafrontals with brownish infuscation adjoining the frontal vitta; thorax with pronounced deep seal-brown vittae; scutellum with brownish spots at basal angles; abdomen with broad paired brownish marks on terga 1+2, 3, and 4, which are not well defined; tergum 5 with a dorsocentral vitta; ovipositor with sclerites polished, anal plates with weak spinules.

Fore tibia with no median posterior bristle; mid femur with no bristles at base of ventral surface, antero- and posteroventral surfaces with no series of bristles; mid tibia with 2 anterodorsal and 2 posterior bristles; hind femur with a series of 4 or 5 bristles on distal half of anteroventral surface; hind tibiae with 3 anteroventral, and 2 anterodorsal bristles, and 2 setulose bristles on posterior surface.

Length, 6 mm.

RECORDS:—

8 ♂, 4 ♀, Naknek Lake, Savonoski, Alaska, June 1919; 5 ♂, 5 ♀, July, 1919. (J. S. Hine)

Type and allotype in the collection of Professor J. S. Hine, Columbus, Ohio,

Paratypes in the collection of the United State National Museum.

The species belongs to the *semiglobosa* group, which is characterized by having a stout spinelike bristle at base of ventral surface of mid femur in male. There are in all three additional species possessing this character that are reported for the first time as new to science.

This species may be separated from *semiglobosa* Ringd. and *instans* (p. 116) by the broader frons, broader parafacials, and by the possession of distinctive vittae on postsutural area of mesonotum in the male. The remaining species, *monacantha* Collin, may be readily distinguished from the others comprising the group by the black polished appearance of apex of processes of fifth sternum in the male.

Limnophora (Spilogona) instans new species

MALE, blackish; head with parafrontals and parafacials whitish pruinescence, with blackish reflections; cheeks reddish black, with light brownish pruinescence; frontal triangle and proboscis polished; frontal vitta black with whitish pruinescence; antennae and palpi black. Thorax blackish, subshining, paler on presutural area, with trace of dorsocentral vitta; scutellum

entirely black. Abdomen with bluish gray pruinescence on cephalolateral angles of terga 3, 4, and 5, terga 1+2 entirely blackish; terga 3, 4, and 5 with large black paired marks, obscurely separated owing to the infuscation on the intervening space; basal sclerite of hypopygium and sternum 5 blackish, subshining. Legs blackish, the hind legs more or less brownish black. Wings, calyptræ, and pulvilli slightly tinged, the former more densely infuscated basad; veins brownish black; halteres blackish.

Head with eyes separated by a distance about equal to diameter of anterior ocellus; parafrontals contiguous; frontal vitta small, constricted; parafrontal bristles continued in series caudad to a level with apex of frontal triangle; parafacials in profile linear, narrower than breadth of third antennal segment; cheeks well maintained caudad, in height fully equal to breadth of third antennal segment, the latter about one and three-quarter times as long as wide.

Thorax with presutural acrosticals setulose, with four pairs of postsutural dorsocentral bristles; sternopleural bristles arranged 1:2.

Abdomen cylindrical; tergum 3 with large expansive trapezoidal marks, the inner margins of which are subparallel; tergum 4 with less expansive and more widely separated subtriangular marks, the inner margins of which diverge cephalad; tergum 5 with narrower and more obscure triangular markings; sternum 5 sparsely setulose, with a few short bristles at apex of processes.

Fore tibia with no posterior bristle: mid femur with a strong short prebasal bristle on ventral surface; mid tibia with anterodorsal bristle setulose, indistinct, with 1 or 2 posterior bristles: hind femur with 4 or 5 bristles on distal half of anteroventral surface, posteroventral surface with no series of bristles; hind tibia with 1 or 2 anteroventral, and 2 anterodorsal bristles, and with 1 or 2 weaker posterior bristles; tarsi slender, longer than their respective femora. Wings with veins *R.* 4+5 and *M.* 1+2 slightly divergent toward wing margin, *m-cu* cross vein straight.

Length, 5.5 mm.

RECORD:—

1 ♂, Camp 327, Alaska, Alask. Eng. Comm., July 13, 1921.
(J. M. Aldrich)

Type in the collection of the United States National Museum.

The species resembles *semiglobosa* in that in the male the parafacials in profile are reduced to lineal dimensions, the eyes are separated by a distance not greater than that between posterior ocelli, and the mesonotum is entirely black caudad of transverse suture. However in *semiglobosa* the parafrontals are very finely divided caudad by the continuation of the frontal vitta, whereas in *instans* the parafrontals are contiguous, interrupting the con-

tinuity of the frontal vitta. The abdominal marks in the male of *instans* are larger and extend to the ventral region, whereas in *semiglobosa* the abdominal marks are of moderate size and are confined to the dorsum.

The type of *instans* together with specimens of *sospita* were submitted to Mr. Ringdahl for comparative study.

***Limnophora (Spilogona) semiglobosa* Ringdahl**

Limnophora semiglobosa Ringdahl, Ent. Tidskr., 1916 XXXVII p. 238.— Ringdahl, Ent. Tidskr., 1918 XXXIX pp. 170.183.— Ringdahl, Tromsø Museums Årshefter, 1928 (1926) XLIX No. 3 p. 30.

Limnophora (Spilogona) semiglobosa Collin, Trans. Ent. Soc. London, 1930 LXXVIII Pt. 2 p. 275.

The species has been doubtfully identified by Mr. J. E. Collin from one female as occurring in East Greenland. The only example of the species that I have seen is a male specimen from Mt. Washington, New Hampshire, in the collection of the Boston Society of Natural History which is labelled in Malloch's handwriting *Limnophora semiglobosa* Ringd. My notes of the specimen reveal certain discrepancies between them and the description of *semiglobosa* by Ringdahl which lessens my confidence in the retention of this species as occurring in North America. The thorax of the Mt. Washington specimen is described as densely grayish white pollinose with traces of three vittæ, median and sublaterals, and the fore tibia has a median posterior bristle, whereas in *semiglobosa* the thorax is described as black, and the fore tibia has no median posterior bristle.

***Limnophora (Spilogona) setilamellata* new species**

MALE, head with parafacials and parafrontals silvery pruinulent; cheeks whitish pruinulent with dark reflections; frontal triangle polished, frontal vitta viewed from below whitish pollinose; proboscis shining; antennæ and palpi black. Thorax blackish, subshining, with trace of pruinescence, with three narrow vittæ, scutellum blackish. Abdomen whitish pollinose, with terga 1+2 largely black, terga 3 and 4 with large black markings, tergum 5 with dark reflections; basal sclerite of hypopygium subshining, blackish. Legs blackish; pulvilli tinged. Wings clear, veins light brown; calyptre whitish; halteres blackened.

Head with eyes separated by a distance about equal to that between posterior ocelli; frontal vitta constricted by the contiguity of parafrontals;

parafrontal bristles continued in series caudad to a level with narrowest distance between the eyes; parafacials at base of antennæ scarcely equal to breadth of third antennal segment; cheeks narrowed throughout the caudal half by the gradual curvature of ventral margin of head, the buccal area pronounced, the vibrissal angle extending cephalad to a level with base of antennæ; antennæ short, third segment but little longer than second, arista almost bare.

Thorax with two closely adjacent series of four or five pairs of fine setulose acrosticals, with four pairs of postsutural dorsocentral bristles; sternopleural bristles arranged 1:1.

Abdomen stoutly developed, cylindric-conical; tergum 3 with black trapezoidal marks, tergum 4 with smaller marks which are more constricted cephalad; abdominal sterna gradually increasing in breadth caudad, sterna 3 and 4 broader than long; sternum 5 deeply incised, the processes armed with a dense matt of black spinules on inner surface, the inner margin with a dense series of fine setulæ on apical half.

Fore tibia with a fine median posterior bristle: mid femur with a series of short erect bristles on proximal half and with a series of longish appressed setulæ on distal half of anteroventral surface, with a series of bristles on proximal two-thirds of posteroventral surface; mid tibia with 1 anterodorsal, and 2 posterior bristles: hind femur with 4 bristles on distal half of anteroventral surface, and with a series of distinctive bristly hairs on proximal half of anteroventral surface and posteroventral surface, the latter series with bristly hairs scarcely longer than apical setulæ; hind tibia with 1 or 2 anteroventral, and 3 anterodorsal bristles, the posterodorsal surface with 1 or 2 setulose bristles. Wings with veins *R.* 4 + 5 and *M.* 1 + 2 slightly divergent towards wing margin; *m-cu* cross vein slightly sinuate.

FEMALE, similar to male, abdomen subshining, with trace of grayish pruinescence, markings on terga 3 and 4 expansive, subtriangular; tergum 5 with a dorsocentral vitta; halteres blackened.

Parafrontals with a few setulæ; ovipositor with fine setulæ on anal plates. Fore tibia with 2 posterior bristles: mid legs missing: hind femur with a series of bristles on anteroventral surface, with a series of bristly hairs on proximal half of antero- and posteroventral surfaces; hind tibia with 1 anteroventral, and 3 anterodorsal bristles, the posterodorsal surface with 2 setulose bristles.

Length, 5 mm.

RECORD:—

1 ♂, 1 ♀, White Mts., New Hampshire. (Morrison)

Type and allotype in the collection of the United States National Museum.

The male of the above species may be readily differentiated from allied forms by the peculiar armature of processes of fifth

abdominal sternum. In the female specimen the halteres are blackened, the frontal vitta is black with whitish pruinescence, the anal plates of ovipositor are clothed with setulæ.

***Limnophora (Spilogona) tendipes* Malloch**

Limnophora tendipes Malloch, Ohio Journ. Sci., 1920 XX No. 7 p. 269.

RECORD:—

1 ♂, Cordova, Alaska. (J. S. Hine)

The species is only known to me by the male type cited above. It is readily recognized owing to its unique appearance. The head is about as long as high, having the face prominently inflated as in the genus *Hammomyia*. The oral margin is protruded beyond a level with base of antennæ, the latter are small and conspicuously separated at base by a large silvery facial elevation; the eyes possess a few hairs and are broadly separated; the frons whitish pruinose, and the parafrontal bristles weakly developed; the palpi and proboscis are elongated and narrow, the former flattened, spatulate; the thorax is bluish gray pruinose, with numerous setulæ and relatively short macrochaetæ; the scutellum is setulose, with numerous setulæ at base of lateral declivities and a few setulæ apically adjacent the apical bristles; the mesopleural series of bristles possesses numerous accessory bristles dorsad; the abdomen is flattened, compressed dorso-ventrad, with a conspicuous dense series of curling bristles on basal sclerite of hypopygium; the abdominal markings appear "faded," with trace of darker markings on terga three and four, between which lies a dorsocentral vitta; the hind metatarsus has a basal spine on ventral surface.

***Limnophora (Spilogona) almquistii* (Holmgren)**

Aricia almquistii Holmgren, Nov. Spec. Ins., 1881 p. 17.—Holmgren, Ent. Tidskr., 1883 IV p. 167.

Limnophora almquistii Stein, Wien Ent. Zeitg., 1902 XXI p. 56.

Limnophora angulata Malloch, Trans. Amer. Ent. Soc., 1920 XLVI No. 802 p. 151.—Frison, Bull. Ill. Nat. Hist. Surv., 1927 XVI Art. 4 p. 203.

Limnophora rostrata Ringdahl, Ent. Tidskr., 1920 XLI p. 26.

Melanochelia angulata Malloch, Canad. Ent., 1921 LIII p. 63.—

Frison, Bull. Ill. Nat. Hist. Surv., 1927 XVI Art. 4 p. 204.

Limnophora (*Spilogona*) *almquisti* Collin, Trans. Ent. Soc. London, 1930 LXXVIII Pt. 2 p. 259.

The species is known only to occur in Greenland on the North American continent. The synonymy I have accepted from Collin (6a), who has examined the male and female paratypes of *angulata*. I give herewith a fuller description of the type and allotype of *angulata* than that of the original.

Male: a robust species with numerous fine setulæ and bristles. Eyes with a few hairs, separated by a distance equal to diameter of anterior ocellus; parafrontals contiguous, linear, parafrontal bristles fine, continued in series caudad to a level with anterior ocellus; parafacials narrow, at base of antennæ narrower than breadth of third antennal segment; antennæ small, separated at base by a large bulbous swelling of the face; proboscis polished; vibrissal angle protruded slightly beyond a level with base of antennæ; cheeks invaded by a dense clothing of fine setulæ, notably on the buccal area.

Thorax blackish; mesonotum with five dark vittæ distinctly outlined, with four pairs of postsutural dorsocentral bristles; scutellum with a series of fine setulæ on dorsal margin of lateral declivities adjacent apical bristles; mesopleural series of bristles with an intermediate predorsal bristle; sternopleural bristles arranged 1:1. Halteres with knobs blackened; calyptre whitish, the lower scale pointed. Wings clear, slightly infuscated basad.

Abdomen robust, shining, deep brownish black with very little trace of markings, viewed from behind with trace of grayish pruinescence at cephalolateral angles of terga: sternum one with 1 or 2 setulæ, processes of fifth sternum with numerous fine longish setæ on inner border.

Fore tibia with 1 or 2 fine longish bristles on posterior surface: mid femur with a series of fine long bristles on proximal half of anteroventral surface, and throughout the posteroventral surface; mid tibia with 1 anterodorsal, and 3 longish posterior bristles, and 1 or 2 short posteroventral bristles: hind femur with an entire series of long anteroventral bristles, the posteroventral

surface with much finer bristles on proximal half; hind tibia with 4 anteroventral, 3 anterodorsal, and 2 weaker posterior bristles.

Female: head with frontal vitta opaque black with a long narrow brownish frontal triangle; parafrontals entirely brownish infuscated, each equal to about half width of frontal vitta, with numerous setulæ and in addition with a series of fine setulose bristles mesad of parafrontal bristles along the margin of frontal vitta; parafacials and cheeks broad, wider and higher respectively than breadth of third antennal segment, with grayish pruinescence, the cheeks with a darkened rectangular reflective area at cephaloventral angle of eye and with a dense series of short fine setulæ along the ventral border. Eyes smallish; second antennal segment short; arista bare, thickened proximad; palpi as long as height of eye. Mesonotum blackish, with trace of vittæ, humeral and notopleural callosities of a contrasting paler grayish color, otherwise as in male; halteres black. Abdomen subshining, with trace of darker expansive markings on terga 3 and 4; anal plates of ovipositor with fine setulæ.

Fore tibia with two posterior bristles: mid femur with a series of fine bristles on antero- and posteroventral surfaces; mid tibia with 2 anterodorsal and 2 posterodorsal and 1 posterior bristle: hind femur with an entire series of anteroventral bristles and a series of finer bristles on proximal half of posteroventral surface; hind tibia with 3 or 4 anteroventral, 3 or 4 anterodorsal bristles, and 1 or 2 setulose bristles on posterior surface. Length, 7 mm.

***Limnophora (Spilogona) sanctipauli* (Malloch)**

Limnophora triangulifera Lundbeck not Zetterstedt, Vidensk.

Medd. Naturh. Foren. Kjöbenhavn, 1898 I p. 312.

Limnophora megastoma Frey not Boheman, Mem. Acad. Sci. Russ., 1915 XXIX p. 27.

Melanochelia sanctipauli Malloch, Proc. Calif. Acad. Sci., 1921 ser. 4 XI p. 180.—Malloch, N. A. Fauna No. 46, Bur. Biol. Surv., U. S. Dept. Agric., 1923 p. 191.

Limnophora (Spilogona) sanctipauli Collin, Trans. Ent. Soc. London, 1930 LXXVIII Pt. 2 p. 274.—Collin, Ann. Mag. Nat. Hist., 1931 ser. 10 VII p. 83.?

RECORDS:—

Alaska, 2 ♀, St. Paul Island, July 12, 1920. (G. D. Hanna)

1 ♂, 1 ♀, Point Barrow, July 13, 1882. (John Murdock)

North West Territories, 1 ♀, Pond Inlet, Sept. 6, 1925. (R.

Finnie) 1 ♀, Hersettell Isl., July 29, 1916. (F. Johansen, Canad. Arct. Exped.)

Baffin Land, 1 ♂, Nettilling Lake, July 22, 1925; 1 ♂, 1 ♀, July 9, 1925. (J. D. Soper)

Greenland, 2 ♂, 1 ♀, Cape Hatherton, N. of Etah, Aug. 13, 1925. (McMillan Exp.)

The species was described from St. Paul Island, Alaska. It is evidently a common and widely distributed species in the Arctic regions of North America. One of the paratypes of *pearyi* Malloch is undoubtedly a specimen of *sanctipauli*. Through the kindness of Dr. E. P. Van Duzee I have been able to examine the female paratypes of *sanctipauli* which agree in every important respect with the above females from Baffin Land and Greenland. One of the paratypes has three pairs of postsutural dorsocentral bristles, and the other four pairs, the number that is considered normal. The species has light grayish pruinescence with five well marked vittæ on mesonotum, the median three being broad and extended onto the presutural area, the lateral vittæ terminate at the transverse suture and are not so distinctive. In these respects the species differs markedly from allied forms, such as *almquistii*, *tristiola*, and *extensa*, in which the thorax is largely blackish, thus obscuring any trace of vittæ on the postsutural area of mesonotum. The abdomen has two pairs of conspicuous blackish subtriangular marks on a grayish background as in *tristiola*, but the wings are not so markedly hyaline as in that species. The cerci in the male are elongated and are conspicuously glossy and polished, extending distad as a single fused lamella. In the female the halteres are blackish, the parafrontals are grayish pruinescent with brownish infuscation along the border adjacent the frontal vitta, and the hind femur has an entire series of anteroventral bristles.

Limnophora (*Spilogona*) *tristiola* (Zetterstedt)

Anthomyza tristiola Zetterstedt, Ins. Lapp., 1838, p. 675.

Anthomyza triangulifera Zetterstedt, Ins. Lapp., 1838, p. 680.

Aricia triangulifera Zetterstedt, Dipt. Scand., 1845 IV p. 1467.—
Staeger, Kröjers Naturh. Tidsskr., 1845 ser. 2 I p. 364.—Zet-
terstedt, Dipt. Scand., 1860, XIV p. 6219.

Aricia vitticollis Zetterstedt, Dipt. Scand., 1845 IV p. 1471.

Aricia tristiola Zetterstedt, Dipt. Scand., 1845 IV p. 1499.

Limnophora triangulifera Osten Sacken, Misc. Coll. Smithsn.
Inst., 1878 III p. 167.—Hagen, Canad. Ent., 1881 XIII No. 1
p. 47.—Aldrich, Misc. Coll. Smithsn. Inst., 1905 XLVI No.
1444 p. 547.—Stein, Katalog Paläark. Dipt., 1907 III p. 675.—
Stein, Arch. f. Naturgesch., 1914 (1913) Abt. A Heft 8 p. 28.
—Stein, Arch. f. Naturgesch., 1916 (1915) Abt. A Heft 10 p.
111.—Ringdahl, Ent. Tidskr., 1918 XXXIX pp. 159. 166. 180.
—Collin, Ann. Mag. Nat. Hist., 1923 ser. 9 XI p. 118.—Ring-
dahl, Tromsö Museums Ärshefter, 1928 (1926) XLIX No. 3 p.
30.

Limnophora tristiola Stein, Katalog Paläark. Dipt., 1907 III p.
675.

Limnophora vitticollis Stein, Katalog Paläark. Dipt., 1907 III p.
676.

Limnophora (Spilogona) triangulifera Schnabl and Dziedziicki,
Abh. d. Kaiserl. Leop.—Carol. Deutsch. Akadem. d. Natur-
forsch., 1911 XCV Nr. 2 p. 154.

I am very doubtful whether this species should be cited as oc-
curring in North America, the more so since Collin (6a) in ex-
amining Lundbeck's material has assigned those specimens to
sanctipauli Malloch. Undoubtedly Stein (56) based his Green-
land records on the same material. In 1878 Osten Sacken (36)
recorded the species in his catalogue of North American diptera,
from specimens submitted to Meade for identification. The
specimens on which a study of the species has been based were
collected by Mr. Ringdahl in Sweden.

The species very closely resembles *alberta* (p. 143), both hav-
ing hairs on eyes, though only a few in *tristiola*, the thorax is
deep black, the wings strikingly hyaline, the calyptreae white, and
the abdomen with two pairs of conspicuous black marks. How-
ever in *tristiola* the oral margin is protruded beyond a level with
base of antennae whilst in *alberta* the oral margin does not ex-
tend beyond a level with base of antennae. In the female, *tris-*

tiola has a long fine posterior bristle on fore tibia which is lacking in *alberta*.

Limnophora (Spilogona) megastoma (Boheman)

Aricia megastoma Boheman, Öfversigt Kaiserl. Vetens. Akadem. Förhandling., 1865 XXII p. 572.—Holmgren, Kaiserl. Svensk. Vetens. Akadem. Handlung., 1869 VIII No. 5 p. 29.

Aricia triangulifera Boheman not Zetterstedt, Öfversigt Kaiserl. Vetens. Akadem. Förhandling., 1865 XXII p. 572.

Aricia ludibunda Holmgren, Kaiserl. Svensk. Vetens. Akadem. Handlung., 1869 VIII No. 5 p. 32.

Aricia pauxilla Holmgren, Kaiserl. Svensk. Vetens. Akadem. Handlung., 1869 VIII No. 5 p. 32.—Holmgren, Öfversigt Kaiserl. Vetens. Akadem. Förhandling., 1873 (1872) XXIX No. 6 p. 101.—Osten Sacken, Misc. Coll. Smithsn. Inst., 1878 III p. 164.

Limnophora arctica Becher not Zetterstedt, Österreichische Polarstation Jan Mayen: Insekten, 1886.

Limnophora ludibunda Stein, Wien Ent. Zeitg., 1902, XXI p. 59.

Limnophora pauxilla Stein, Wien Ent. Zeitg., 1902 XXI p. 61.—Aldrich, Misc. Coll. Smithsn. Inst., 1905 XLVI No. 1444 p. 547.—Stein, Katalog Paläark. Dipt., 1907 III p. 673.—Collin, Ann. Mag. Nat. Hist., 1923 ser. 9 XI p. 118.

Limnophora megastoma Stein, Wien Ent. Zeitg., 1902 XXI p. 64.—Stein, Katalog Paläark. Dipt., 1907 III p. 672.—Ringdahl, Ent. Tidskr., 1918 XXXIX Haft 2 pp. 167. 180.—Collin, Ann. Mag. Nat. Hist., 1923 ser. 9 XI p. 119.—Collin, Ann. Mag. Nat. Hist., 1924 ser. 9 XIV p. 201.

Limnophora dorsata Ringdahl, in part, Ent. Tidskr., 1918 XXXIX Haft 2 pp. 159. 167.

Limnophora (Spilogona) megastoma Collin, Ann. Mag. Nat. Hist., 1924 ser. 9 XIV p. 204.—Collin, Trans. Ent. Soc. London, 1930 LXXVIII Pt. 2 p. 268.

This species has been recognized by Mr. J. E. Collin as occurring on the eastern littoral of Greenland. I have before me two specimens from Sweden, kindly furnished by Mr. O. Ringdahl, which form the basis of the present study of the species.

The species belongs to that group having normally four pairs of postsutural dorsocentral bristles, the halteres blackish or brownish, the oral margin protruded, and the mid tibia with no median ventral bristle. Evidently there are occasions when a series of specimens may exhibit only three pairs of strong postsutural dorsocentral bristles as indicated by Collin (6).

The species is related to *tristiola* and *extensa* in that the mesonotum is largely blackish infuscated with no definite vittae. The male of *megastoma* differs essentially from that of *tristiola* in that the pleura of thorax are not entirely intensively blackened, but exhibit a trace of grayish pruinescence: from the male of *extensa* the species may be distinguished by the longer bristles on proximal half of posteroventral surface of hind femur, and by the wider separation of the eyes. In the female of *megastoma* the scutellum is grayish pruinose mesad with black marks laterad, whereas in *tristiola* and *extensa* the scutellum is entirely blackish with trace of brownish pruinescence.

Limnophora (Spilogona) extensa Malloch

Limnophora extensa Malloch, Trans. Amer. Ent. Soc., 1920 XLVI No. 802 p. 150.—Frison, Bull. Ill. Nat. Hist. Surv., 1927 XVI Art. 4 p. 203.

Melanocheilia extensa Malloch, Canad. Ent., 1921 LIII p. 63.

Limnophora (Spilogona) extensa Collin, Trans. Ent. Soc. London, 1930 LXXVIII Pt. 2 p. 264.

The species is described from Greenland, specimens of which have been seen in the collections of the American Entomological Society and of the Illinois Natural History Survey. The series in the former collection consists of two species, in my opinion, namely, the male type and three female paratypes are *extensa*, whilst the remaining three female paratypes are *sanctipauli*. As indicated in the keys the species runs very closely with *tristiola* and *megastoma*. The following descriptive notes were made of the type and allotype.

Male: eyes nearly contiguous, separated by a distance equal to diameter of anterior ocellus; parafrontals contiguous, linear; parafrontal bristles finely developed, continued in series caudad to a level with anterior ocellus; cheeks narrow, elongate, con-

stricted caudad by the gradual upward curvature of caudoven-tral margin of head capsule, vibrissal area strongly protruded. Parafacials at base of antennae equal in breadth to that of third antennal segment; antennae separated at base by a rounded facial prominence, third antennal segment barely longer than second; arista nearly bare, thickened basad; proboscis polished.

Thorax blackish with trace of brownish pruinescence, pre-sutural area with grayish pruinescence and trace of median vitta; scutellum entirely black, subshining; halteres black; wings hyaline; calyptæ white.

Abdomen cylindrico-conical, with grayish pruinescence, and paired black markings on terga 3 and 4; fifth abdominal sternum broadly incised, with a group of fine bristles at apices.

Legs with long fine bristles and setulæ; fore tibia with no median bristles on posterior surface: mid femur with a series of fine bristles on antero- and posteroventral surfaces; mid tibia with 1 or 2 posterior bristles: hind legs missing.

Female with brownish pruinescence on parafrontals, para-facials and cheeks; eyes nearly bare; vibrissal angle prominently protruded cephalad; thorax with brownish infuscation on meso-notum; darker on the discal area than laterad, no vittæ apparent; halteres black; calyptæ white. Abdomen entirely brownish black, shining, with no definite markings, and with numerous fine longish bristles; ovipositor with fine setulæ on anal plates.

Fore tibia with a median posterior bristle: mid tibia with 1 anterodorsal and 2 posterior bristles: hind femur with fine longish bristles on distal two-thirds of anteroventral surface, and on proximal half of posteroventral surface; hind tibia with fine short bristles, 2 or 3 anteroventral, 1 strong (proximal) and 1 shorter and weaker (distal) anterodorsal bristle, and with 2 setu-lose bristles on posterior surface.

***Limnophora (Spilogona) fatima* new species**

MALE, head with parafrontals, parafacials, and cheeks whitish pruinescent with reddish to blackish reflections; frontal triangle pruinescent; antennæ and palpi blackish; proboscis polished, shining; thorax blackish, subshining, with trace of presutural pruinescence on mesonotum, with three darker, more or less obscure vittæ; scutellum blackish: abdomen with dense whitish pruinescence, with paired blackish markings on terga 1+2, 3, and 4, and occasionally on the fifth tergum, with an interrupted dorsocentral vitta on

all terga, with macrochaetae set in blackish spots; basal sclerite of hypopygium blackish, subshining, with trace of pruinescence: legs black, pulvilli tinged; wings clear, veins brownish black; calyptæ whitish; halteres blackened.

Head with eyes nearly twice as high as long, separated by a distance equal to that between posterior ocelli; parafrontals contiguous, frontal vitta restricted; parafrontal bristles continued in series caudad to a level with apex of frontal triangle; parafacials at base of antennae not prominent, variable in breadth; cheeks slightly higher than breadth of third antennal segment, markedly restricted caudad by the upward curvature of caudoventral margin of head capsule, buccal area prominent; arista nearly bare.

Thorax with two closely adjacent series of irregularly paired acrostical bristles, the presutural bristles of which are stronger developed than the adjacent setulae; with four pairs of postsutural dorsocentral bristles; sternopleural bristles arranged 1: 1.

Abdomen ovate, stoutly developed; tergal markings successively smaller and more widely separated caudad; terga 1+2 largely blackish, the darker areas divided at middle; terga 3 and 4 with markings subtriangular; sternum 5 deeply emarginate, with longish setulae.

Fore tibia with 1 median posterior bristle: mid femur with a series of short bristles or proximal half of anteroventral surface, with a series of bristles on proximal half of posteroventral surface; mid tibia with 1 or 2 anterodorsal, 2 posterior bristles: hind femur with a series of bristles on entire length of anteroventral surface, with a series of bristles on proximal half of posteroventral surface; hind tibia with 2 or 3 anteroventral, and 2 or 3 anterodorsal bristles, the distal bristle of which is stouter developed than the remaining bristles of series, and with 2 or 3 setulose bristles on posterodorsal surface.

Wing with *m-cu* cross vein straight, with veins *R.* 4+5 and *M.* 1+2 divergent toward margin of wing.

FEMALE, paler in color than male; head, thorax, and abdomen largely pale grayish pruinose, opaque; frontal triangle whitish gray pruinose: thorax with three brownish vittae; scutellum with brownish lateral areas at basal angles: abdomen with paired brownish marks on terga 1+2, 3, and 4, with a dorsocentral vitta on all terga; abdominal setae set in brownish spots. Legs grayish black. Wings with *r-m* and *m-cu* cross veins slightly clouded; halteres at least tinged with black.

Head with setulae on parafrontals; parafacials at base of antennae at least as wide as breadth of third antennal segment, narrowed ventrad: eyes about one and a half times as high as long: sternopleural bristles arranged 1: 2. Abdominal marks ill defined; ovipositor with fine setulae on anal plates.

Femora comparatively short and stoutly developed: tibial bristles strongly developed. Fore tibia with a strong apical posteroventral bristle, and with a median posterior bristle: mid femur with a series of bristles on proximal

half of antero- and posteroventral surfaces; mid tibia with 2 anterodorsal, and 2 or 3 posterior bristles; hind femur with a complete series of anteroventral bristles and a series of bristles on proximal half of posteroventral surface; hind tibia with 2 or 3 anteroventral, and 2 anterodorsal bristles, the distal bristle of which is more strongly developed than the proximal bristle, and with 2 or 3 setulose bristles on posterodorsal surface. Length, 4.5-5.5 mm.

RECORDS:—

Quebec, 5 ♂, 1 ♀, Lake Is., June 28, 1929; 1 ♂, Wolf Bay, June 25, 1929; 1 ♂, 2 ♀, Harrington Harbor, June 30, 1929; 1 ♀, July 2, 1929; 1 ♂, 1 ♀, July 3, 1929; 1 ♂, 1 ♀, July 4, 1929, 2 ♂, 2 ♀, Little Mecatina Is., July 6, 1929; 2 ♀, Mutton Bay, July 11, 1929; 1 ♀, Bonne Esperance, July 14, 1929; 1 ♂, 1 ♀, Thunder River, June 11, 1929. (W. J. Brown)

Ontario, 1 ♂, 1 ♀, Mer Bleue, Ottawa, May 28, 1927 (W. J. Brown); 2 ♀, June 2, 1927 (F. P. Ide); 1 ♀, July 7, 1923; 1 ♀, Ottawa, June 2, 1927. (C. H. Curran)

New York, 2 ♂, Maclean Bogs, Maclean, May 7, 1922; 1 ♀, MacLean, July 2-3, 1904.

Manitoba, 1 ♀, Aweme, May 5, 1925. (N. Criddle)

Type and allotype in the Canadian National Collection.

Paratypes in the United States National Museum.

This species is readily distinguished from its closest allied forms on account of its well defined appearance. It is a small, plump, pale gray form with deeply colored, blotchy marks on the abdomen. In both sexes there is a dorsocentral vitta between the paired abdominal marks. In many specimens there are three pairs of presutural dorsocentral bristles and three bristles on each humeral callosity, whilst in other specimens these characters show a high degree of variation. The species runs close to *tetrachaeta* in the key in that the presutural acrosticals are more stoutly developed than the adjacent thoracic setulae; the bristles on the anterodorsal surface of hind tibia are not equal in size, the distal bristle of series being stouter developed than remainder; the halteres are blackened; and the abdomen has a dorsocentral vitta. The two species are however notably different in general appearance, chiefly because of the character of the pruinescence covering the body, and of the extent of the abdomi-

nal marks. In *tetrachaeta* the body pruinescence is cinereous to brownish, and the abdominal marks are ill defined and restricted.

***Limnophora (Spilogona) tetrachaeta* Malloch**

Limnophora tetrachaeta Malloch, Trans. Amer. Ent. Soc., 1920 XLVI No. 802 p. 153.

Melanochelia tetrachaeta Malloch, Canad. Ent., 1921 LIII p. 62.

Spilogona tetrachaeta Johnson, Occ. Pap. Boston Soc. Nat. Hist., No. VII, 1925 p. 229.

RECORDS:—

Montana, 3 ♂, 1 ♀, Bozeman, July 23, 1915; 1 ♀, Lima, July 1, 1913, (Mont. Exp. Sta.)

Alberta, 1 ♂, 2 ♀, Lethbridge, June 26, 1923; 1 ♂, 1 ♀, June 27, 1923. (H. L. Seamans) 1 ♂, Lethbridge, June 26, 1923, on clover blossom. (Walter Carter)

After examining the type of *tetrachaeta* in the collection of the Illinois State Natural History Survey it is evident that the species recorded in the New York State list of insects (21) as *tetrachaeta* is *fatima*. So far as I know *tetrachaeta* is western in its distribution. In both species the bristling of the tibiae is abnormally strong for this genus. The fore tibia has a distinctive median anterodorsal bristle and a stoutly developed apical posteroventral bristle; the mid and hind tibiae have strong bristles on the anterodorsal surface, in the case of the hind tibia the distal bristle of anterodorsal series is stouter developed than the remaining bristles in the same series. In the males of *tetrachaeta* the eyes are separated at narrowest by a distance fully equal to breadth of third antennal segment, the parafrontals are separated throughout by the frontal vitta, whereas in *fatima* the eyes are separated at narrowest by a distance not equal to breadth of third antennal segment, and the parafrontals are contiguous caudad interrupting the frontal vitta. In the females of *tetrachaeta* the scutellum is entirely cinerous pollinose, and the cross vein *m-cu* normally clear, whereas in *fatima* the scutellum has blackish spots at basal angles, and the cross vein *m-cu* is clouded.

***Limnophora (Spilogona) concolor* Stein**

Limnophora concolor Stein, Arch. f. Naturgesch., 1920 (1918) Abt. A Heft 9 pp. 46, 55.

RECORDS:—

North West Territories, 1 ♂, 2 ♀, Nyarling River, July 4, 1926;

1 ♂, 1 ♀, July 11, 1926. (J. Russell)

Alberta, 1 ♀, Banff, Aug. 18, 1922; 1 ♂, 2 ♀, Aug. 21, 1922. (C.

B. D. Garrett): 1 ♀, 1 ♂, Jasper, July 25, 1926. (J. McDunnough)

Manitoba, 1 ♂, Winnipegosis, July 13, 1926. (E. Criddle)

Wyoming, 1 ♂, 5 ♀, U. Geyser Basin, Yellowstone Park, Aug. 7, 1918. (A. L. Melander)

There are five species before me which are evidently representative of a group in this subgenus having the head very broad when viewed from in front, much broader than high; the oral margin not protruded beyond base of antennæ; scutellum with appressed setulose hairs on dorsum of lateral declivities adjacent apical bristles, and in the female with the anal plates of ovipositor armed with spinules. Such species are *leucogaster* Zett., *concolor* Stein, *obscuripennis* Stein, *aerea* Zett., and *addicta* (p. 133).

The male of *concolor* is readily distinguished from those of allied species in that the calyptrae are intensively browned, and the halteres blackened. The males of *anthrax* and *narina* have the calyptrae intensively infuscated also, but the halteres are yellow in the former species and the eyes are much more widely separated in the latter species. In addition the scutellum of both species has no appressed hairs on dorsal margin of lateral declivities adjacent apical bristles. The female of *concolor* has the halteres blackened and the abdomen shining with very little trace of pruinescence, in coloration very similar to the female of *Hebecnema vespertina* Fallen. In addition the frontal triangle is polished as in *aerea*, but the latter has yellowish to brownish halteres and the abdomen has distinctive brownish pruinescence when viewed from behind. I have not seen the female of *leucogaster* but, in my opinion, the female of *concolor* probably closely resembles that of *leucogaster*.

Limnophora (Spilogona) leucogaster (Zetterstedt)

Anthomyza leucogaster Zetterstedt, Ins. Lapponica, 1838, p. 674.

Aricia leucogaster Zetterstedt, Dipt. Scand., 1845 IV p. 1497.—
Zetterstedt, Dipt. Scand., 1860 XIV p. 6227.

Limnophora leucogaster Stein, Katalog Paläark. Dipt., 1907 III p. 671.—Arch. f. Naturgesch., 1916 (1915) Abt. A Heft 10 p. 102.—Ringdahl, Ent. Tidskr., 1918 XXXIX p. 159.—Stein, Arch. f. Naturgesch., 1920 (1918) Abt. A Heft 9 pp. 47, 56.

RECORDS:—

1 ♂, Katmai, Alaska, June 1917. (J. S. Hine): 1 ♂, Healy, Alaska, June 26, 1921. (J. M. Aldrich)

The male of this little known European species superficially resembles those of the genus *Sphenomyia*, differing essentially in that the vein *R*. 4 + 5 has no setulae on under surface of basal section. The species was recorded by Stein (60) from Mt. Rainier, Washington, and in my opinion, if Stein's identification is correct, it is more than probable that *nitidifrons* Stein (60) is the female of the same species. I am, however, doubtful whether the specimens that Stein had before him were *leucogaster*. They may have been *Sphenomyia biquadrata* Walker, a species which has been taken by Garrett and Seamans at Banff and Oliver in the Canadian Rockies.

Another species which has the abdomen silvery pruinose in the male is *argentiventris* Malloch. The male of this species differs from that of *leucogaster* in having the halteres yellow, the hind femur with a few short bristles on proximal half of posteroventral surface, and the scutellum with no setulose hairs on dorsal margin of lateral declivities adjacent apical bristles.

Limnophora (Spilogona) obscuripennis Stein

Limnophora obscuripennis Stein, Arch. f. Naturgesch., 1916 (1915) Abt. A Heft 10 p. 93.—Ringdahl, Tromsø Museums Årshefter, 1928 (1926) XLIX No. 3 p. 29.

RECORDS:—

Alaska, 3 ♂, 2 ♀, Naknek Lake, Savonoski, June 1919; 1 ♀, July 1919; 1 ♂, 1 ♀, July 27, 1919; 2 ♂, July 28, 1919. (J. S. Hine)

Colorado, 1 ♂, Tenn. Pass, July 23, 1917; 1 ♀, 1024 ft., July 10—(J. M. Aldrich)

The species most closely resembles *aerea* and *addicta* (p. 133), from which it may be separated in both sexes by the possession of a series of short bristles on proximal half of posteroventral

surface of hind femur. In the female of *obscuripennis* and *addicta* the frontal triangle and proboscis are pollinose, not polished as in *aerea*.

***Limnophora (Spilogona) addicta* new species**

MALE, blackish; parafrontals, parafacials, and cheeks whitish pruinose; frontal triangle polished; proboscis lightly pollinose, subshining; abdomen with dense grayish pruinescence, terga 3 and 4 with blackish marks when viewed from behind. Wings smoky, but little darkened basad. Calyptræ infuscated; halteres blackened, sometimes brownish. Pulvilli whitish.

Head with eyes separated by a distance not greater than that between posterior ocelli, parafrontals contiguous cephalad of anterior ocellus; frontal vitta gradually broadened cephalad. Parafacials, in profile, receding ventrad, at base of antennæ slightly protruding beyond a level with vibrissæ; cheeks with a prominent series of upcurved bristles. Thorax with an intermediate predorsal bristle in marginal series on mesopleura. Abdomen with a pair of large subquadrate marks on tergum 3, with a pair of smaller, more widely separated subtriangular marks on tergum 4, tergum 5 unmarked; basal sclerite of hypopygium lightly pollinose, faintly subshining.

Fore tibia with no median posterior bristle; mid femur with a series of longish bristles on proximal half of posteroventral surface; mid tibia with 2 median posterior bristles; hind femur with 4 or 5 bristles on distal half of anteroventral surface, posteroventral surface with no series of short bristles on proximal half; hind tibia with 2 to 4 anteroventral, and 2 or 3 anterodorsal bristles, the posterior surface with or without weak setulose bristles.

FEMALE, similar to male; parafrontals brownish infuscated; parafacials and cheeks paler; frontal triangle pollinose. Thorax grayish black, the mesonotum and scutellum largely more or less brownish infuscated. Abdomen concolorous with thorax, subshining, with paired brownish subtriangular marks on terga 3 and 4, the markings more or less indistinct. Calyptræ yellowish tinged; halteres brownish to yellowish. Ovipositor armed with spinules on anal plates.

Fore tibia with no median posterior bristle; mid femur with 2 or 3 fine bristles on proximal third of posteroventral surface; mid tibia with or without an anterodorsal bristle, with 2 median posterior bristles; hind femur with 4 or 5 bristles on distal half of anteroventral surface, posteroventral surface with no series of short bristles; hind tibia with 2 to 4 anteroventral, 2 or 3 anterodorsal bristles, and with or without 1 or 2 setulose bristles on posterior surface. Length, 4.5-5.0 mm.

RECORDS:—

3 ♂, 2 ♀, Naknek Lake, Savonoski, Alaska, June 1919; 1 ♀, July 1919; 1 ♀, July 28, 1919; 1 ♂, Aug. 1, 1919; 1 ♀, Aug. 14, 1919. (J. S. Hine) 1 ♂, Katmai, Alaska, June 10, 1919.

(J. S. Hine) 1 ♂, 1 ♀, Anchorage, Alaska, June 13, 1921; 1 ♀, June 15, 1921. (J. M. Aldrich)

Type and allotype in the collection of Professor J. S. Hine, Columbus, O.

Paratypes in the collection of the United States National Museum.

The males of *addicta* most closely resemble those of *aerea*. The males of both species may be distinguished from those of *obscuripennis* by the lack of short bristles on proximal half of posteroventral surface of hind femur, by the possession of one or two intermediate predorsal bristles in the marginal series on mesopleura, and by the fact that the wings, if infuscated, are uniformly tinged, being little if any darker basad. The males of *addicta* and *obscuripennis* however agree and thereby differ from those of *aerea* in that the marks on tergum three are separated along the dorsocentral plane into two trapezoidal areas, whilst those on *aerea* are fused together. In addition the males of *addicta* have the halteres blackened and the abdominal terga of segments three, four, and five, with lighter pruinescence and, in contrast, more distinctly defined marks, whereas in *aerea* and *obscuripennis* the abdomen has darker pruinescence, and as a result less well defined marks.

The females of *addicta* most closely resemble those of *obscuripennis* in that the frontal triangle and proboscis are more or less pollinose, whereas in the females of *aerea* the frontal triangle and proboscis are polished. However in common with *aerea* they differ from *obscuripennis* in that the hind femur has no series of short bristles on proximal half of posteroventral surface, and the mesopleural series of bristles possesses one or two weaker intermediate predorsal bristles.

***Limnophora (Spilogona) pusilla* new species**

MALE, black; parafrontals and parafacials silvery pruinose; cheeks duller, with dark reflections; frontal triangle and proboscis polished; frontal vitta with brownish pruinescence; antennæ and palpi black. Thorax blackish, subshining; vittæ more or less obscured; pleura blackened. Abdomen slate gray pruinose with terga 1+2 entirely blackish; terga 3 and 4 well marked; tergum 5 with a more or less infuscated marking on dorsocentral plane; hypopygium and sternum 5 blackish, basal sclerite of hypopygium with trace of pruinescence, subshining. Legs blackish, pulvilli

tinged. Wings smoky, more densely infuscated basad: calyptræ tinged, the lower scale with margin markedly dark brownish infuscated. Halteres deep yellowish, with extensive purplish infuscation.

Head with eyes separated by a distance slightly greater than diameter of anterior ocellus; parafrontals contiguous; parafrontal bristles continued in series caudad to about level with apex of frontal triangle; parafacials at base of antennæ slightly narrower than breadth of third antennal segment, constricted ventrad; cheeks about as high as breadth of third antennal segment; palpi with most of the setulæ very short.

Thorax with presutural acrosticals setulose, with four pairs of post-sutural dorsocentral bristles; sternopleural bristles arranged 1:2. Scutellum with a few fine setulose hairs on dorsal margin of lateral declivities adjacent apical bristles.

Abdomen broadly subovate; tergum 3 with markings larger and more narrowly separated than those on tergum 4, trapezoidal in outline; tergum 4 with markings subtriangular, inner margins divergent cephalad; tergum 5 with markings obscure and variable; sternum 5 with a uniform covering of fine setulæ.

Fore tibia with or without a fine posterior bristle: mid femur with a series of fine bristles on proximal third of anteroventral surface, with a series of bristles on proximal two-thirds of posteroventral surface; mid tibia with or without a fine anterodorsal bristle, and 2 posterior bristles: hind femur with 4 or 5 bristles on distal half of anteroventral surface, with no setulose bristles on proximal half of posteroventral surface; hind tibia with 1 or 2 anteroventral, and 1 anterodorsal bristle, the normal weak bristles on posterior surface not evident.

Length, 4 mm.

RECORDS:—

1 ♂, Tennessee Pass, Colorado (10,240 ft.). (J. M. Aldrich)

1 ♂, Nettiilling Lake, Baffin Land, July 9, 1925. (J. D. D. Soper)

Type in the United States National Museum.

The male of this species resembles that of *denudata* Holmgren. Both species possess pale grayish pruinescence on abdomen, on which the abdominal marks are clearly outlined, and both species possess two or three setulose hairs on dorsal margin of lateral declivities of scutellum adjacent the apical bristles. In the latter respect the species agrees with *aerea* and *addicta*, but from both these species it may be distinguished by the lack of a weak pre-dorsal bristle among the mesopleural series of bristles.

In the male of *pusilla* the hind tibia has only one well developed median bristle on anterodorsal surface, the lower calyptra

has the margin dark brownish infuscated, the parafacials at base of antennae slightly narrower than width of third antennal segment, the cheeks about as high as width of third antennal segment, and the hind femur has at most a few fine setulae at base of posteroventral surface, whereas in *denudata* the hind tibia has two or three anterodorsal bristles, the lower calyptra has the margin yellowish, the parafacials at base of antennae as wide as breadth of third antennal segment, the cheeks fully as high as breadth of third antennal segment, and the hind femur has a single short bristle on proximal third of posteroventral surface.

***Limnophora (Spilogona) denudata* (Holmgren)**

Aricia denudata Holmgren, Kaiserl. Svensk. Vetens. Akadem. Handlung., 1869 VIII No. 5 p. 30.—Holmgren, Öfvers. Kongl. Vetens. Akadem. Förhl., 1873 (1872) XXIX No. 6 p. 101.—Osten Sacken, Misc. Coll. Smithsn. Inst., 1878 III p. 164.

Aricia ranunculi Holmgren, Kaiserl. Svensk. Vetens. Akadem. Handlung., 1869 VIII No. 5 p. 34.—Holmgren, Öfvers. Kongl. Vetens. Akadem. Förhl., 1873 (1872) XXIX No. 6 p. 101.—Osten Sacken, Misc. Coll. Smithsn. Inst., 1878 III p. 164.

Limnophora contractifrons Lundbeck in part, Videns. Medd. Naturhist. Foren. Kjöbenhavn, 1898 I p. 311.

Limnophora denudata Stein, Wien Entom. Zeitg., 1902 XXI p. 57.—Aldrich, Misc. Coll. Smithsn. Inst., 1905 XLVI No. 1444 p. 547.—Stein, Katalog Paläark. Dipt., 1907 III p. 670.—Collin, Ann. Mag. Nat. Hist., 1923 ser. 9 XI p. 118.

Limnophora ranunculi Stein, Wien Entom. Zeitg., 1902 XXI p. 62.—Collin, Ann. Mag. Nat. Hist., 1924 ser. 9 XIV p. 202.

Limnophora (Spilogona) denudata Collin, Trans. Ent. Soc. London, 1930 LXXVIII Pt. 2 p. 262.

RECORDS:—

1 ♂, 1 ♀, Nettilling Lake, Baffin Land, July 9, 1925. (J. D. Soper)

The above specimens are in poor condition, but they have been compared with other specimens from Greenland by Mr. J. E. Collin, who bases his identification largely on the structure of the male genitalia. In the male the cerci are exposed, exhibiting a relatively widely separated pair of slender styli, which

gradually converge distad. As indicated in the key to male specimens, the species most closely conforms to *pusilla*.

***Limnophora (Spilogona) aerea* (Fallen)**

Musca aerea Fallen, Dipt. Suec., Muscides, 1825 p. 76.

Anthomyza aerea Zetterstedt, Ins. Lapponica, 1838 p. 686.

Aricia rotundiventris Zetterstedt, Dipt. Scand., 1845 IV p. 1557.

Aricia aerea Zetterstedt, Dipt. Scand., 1845 IV p. 1602.

Limnophora aerea Stein, Ent. Nachr., 1892 XVIII Nos. 20-21 p. 329.—Stein, Katalog Paläark. Dipt., 1907 III p. 669.—Stein, Arch. f. Naturgesch., 1916 (1915) Abt. A Heft 10 pp. 85.96.—Ringdahl, Ent. Tidskr., 1918 XXXIX pp. 168. 174.179.—Stein, Arch. f. Naturgesch., 1920 (1918) Abt. A Heft 9 pp. 48.56.—Ringdahl, Tromsø Museums Ärshefter, 1928 (1926) XLIX No. 3 p. 29.

Aricia (Limnophora) aerea Pandellé, Revue entom. France, 1899 XVIII p. 127.

Limnophora (Spilogona) aerea Collin, Ent. Month. Mag., 1921 ser 3 VII pp. 172.265.—Karl, Tierwelt Deutschlands, 1928 Th. XIII p. 102.—Collin, Trans. Ent. Soc. London, 1930 LXXVIII Pt. 2 p. 277, pls. 17.25.

Spilogona aerea Johnson, Occ. Papers Boston Soc. Nat. Hist., No. VII 1925 p. 229.—Johnson, Insect Fauna, Biol. Surv. Mt. Desert Region, 1927 p. 208.

RECORDS:—

Alaska, 5 ♀, 2 ♂, Popoff Islands, July 8, 1899; 3 ♂, 4 ♀, July 9, 1899; 5 ♂, 6 ♀, July 10, 1899; 3 ♂, 2 ♀, July 11, 1899; 2 ♂, July 12, 1899; 1 ♂, July 13, 1899; 1 ♂, July 14, 1899; 2 ♂, July 15, 1899; 1 ♂, July 17, 1899; 4 ♂, 3 ♀, Saldovia, July 21, 1899. (Harriman Exped. '99. T. Kincaid) 1 ♂, Anchorage, June 15, 1921; 2 ♀, June 16, 1921; 2 ♂, July 19, 1921; 1 ♀, Seward, July 21, 1921. (J. M. Aldrich)

Washington, 3 ♂, Bellingham, May 31, 1917. (H. G. Dyar) 3 ♂, Blynn, Aug. 10, 1921. (A. L. Melander)

Quebec, 2 ♂, Natashquan, Aug. 1, 1929; 1 ♂, 7 ♀, Aug. 2, 1929; 9 ♂, 7 ♀, Aug. 7, 1929. (W. J. Brown) 1 ♂, Anticosti Isle, Aug. 6, 1923. (F. Johansen)

Nova Scotia, 8 ♂, 6 ♀, Kentville, July 3, 1924. (R. P. Gorham)

The males of *aerea* are characterized by the following combination of characters, the lack of a series of short bristles on proximal half of posteroventral surface of hind femur; by the possession of one or two weak bristles situated immediately ventrad of dorsal bristle of mesopleural series (this position being devoid of accessory bristles in closely allied species); by the fact that the wings, if infuscated, are uniformly tinged, being very little if any darker basad. In these respects the species agrees with the male of *addicta*, but differs from the latter species in that the markings on tergum three are fused across the dorsum into a broad black band, and the proboscis is entirely polished. In the female of *aerea* and *addicta* the first two characters mentioned above also hold true, but the female of the former species differs from that of the latter in having the frontal triangle polished and not pollinose.

There is a great deal of variation in the coloration of halteres and calyptæ. In the males they may be yellowish or brownish, or tinged with purple or black, and the calyptæ may be whitish to yellowish.

***Limnophora (Spilogona) pulvicrura* new species**

MALE, blackish; parafrontals, parafacials, and cheeks whitish pruinose with dark, occasionally reddish, reflections; frontal vitta whitish pollinose; antennæ and palpi black; proboscis shining. Thorax blackish, opaque, with whitish pruinescence on presutural region, postsutural area and scutellum darker, with three narrow brownish vittæ and obscure markings laterad, the vittæ most distinct on presutural region; scutellum entirely black; pleura blackened. Abdomen largely blackish on dorsum, markings ill defined but apparently fused across dorsum; the cephalolateral angles of terga 3, 4, and 5 of paler pruinescence when viewed from behind; terga 1+2 entirely blackish. Legs blackish, tibiæ with grayish pruinescence. Wings clear, tinged slightly basad, veins brown. Calyptæ whitish with margins pale yellow; halteres blackened.

Eyes separated by a distance equal to length of third antennal segment; frontal vitta uniformly distinct throughout; parafrontals broad, each about equal to half breadth of frontal vitta, parafrontal bristles weak, continued in series to level with frontal triangle, with few accessory setulæ; parafacials at base of antennæ equal to breadth of third antennal segment; cheeks broad, in height equal to length of third antennal segment, ventral border of cheeks with numerous fine setulæ and bristles; third antennal segment but little longer than broad; arista short, swollen at base.

Mesonotum with numerous setulæ; acrosticals setulose; postsutural dorso-central bristles four pairs; sternopleural bristles arranged 1:1; sternopleura with a noticeable tuft of coarse bristles cephalad of coxa.

Abdomen subcylindrical, with fine bristles and setulæ on terga, marginal and discal series not well differentiated as to size; fifth sternum sparsely setulose, the setulæ becoming longer along inner margin and on apical region, with broad blunt processes, the inner margins of which are slightly attenuated at apex.

Tibial bristles fine and weakly developed. Fore tibia with or without a median posterior bristle: mid femur with a series of short bristles on proximal half of posteroventral surface; mid tibia with or without an anterodorsal bristle, with 1 or 2 posterodorsal bristles: hind femur with 4 to 7 anteroventral bristles on distal half, posteroventral surface bare; hind tibia with 2 anteroventral, and 2 or 3 anterodorsal bristles.

FEMALE, paler in color than male; head, thorax, and abdomen slate gray; head with parafrontals and ventral border of cheek more or less brownish pollinose, concolorous with ocellar triangle. Mesonotum with brownish vittæ, mesopleura brownish pollinose on dorsal border; macrochètæ of mesonotum and scutellum set in brownish spots. Abdomen with paired brownish transverse marks on caudal half of terga 1+2, 3, 4, those on terga 1+2 more or less obscure; fifth tergum unmarked. Halteres deep yellow, tinged with purple. Calyptre whitish or yellowish.

Eyes separated by a distance greater than length of antennæ; parafrontals average one-half to three-quarters as wide as frontal vitta, with numerous setulæ; parafrontal bristles comparatively weak; parafrontals and cheeks in profile broad, the former at base of antennæ and the latter ventrad of eye at least equal to length of third antennal segment. Abdomen with marginal and discal bristles of terga more distinctly differentiated than in male; ovipositor with sclerites polished and shining, anal plates with fine setulæ.

For tibia with 1 or 2 median posterior bristles: mid femur with a few sparsely set bristles on proximal half of posteroventral surface; mid tibia with or without a median anterodorsal bristle, with 2 posterior bristles: hind legs as in male.

Length, 5-6 mm.

RECORDS:—

4 ♂, 9 ♀, Naknek Lake, Savonoski, Alaska, June 1919; 4 ♂, 4 ♀, July 1919. (J. S. Hine)

Type and allotype in the collection of Professor J. S. Hine, Columbus, O.

Paratypes in collection of United States National Museum.

Three males of the above series possess one or more setulæ on the first abdominal sternum. The species superficially resembles

nobilis Stein, from which it differs essentially in both sexes in having no fine bristles on proximal third of posteroventral surface of hind femur, the ventral bristles on sternopleura are coarser and more tufted, and in the female the anal plates of ovipositor possess fine hairs and not spinules.

***Limnophora (Spilogona) carbonella* (Zetterstedt)**

Aricia carbonella Zetterstedt, Dipt. Scand., 1845 IV p. 1414.

Spilogaster carbonella Rondani, Della Soc. Ital. Scienze Naturali, 1866 IX p. 117.—Rondani, Dipt. Ital. Prodr., 1877 VI p. 102.—Stein, Entom. Nachr., 1888 XIV No. 24 p. 372.—Stein, Entom. Nachr., 1893 XIX p. 216.—Strobl, Verh. zool.-bot. Ges. Wien, 1894 (1893) XLIII p. 220.—Slosson, Ent. News, 1895 VI p. 6.—Czerny, Wien Ent. Zeitg., 1901 XX Heft I and 2 p. 37.—Aldrich, Misc. Coll. Smithsn. Inst., 1905 XLVI No. 1444 p. 544.

Spilogaster nigrinervis var *minor* Strobl, Verh. zool.-bot. Ges. Wien, 1894 (1893) XLIII p. 220.

Aricia (Spilogaster) carbonella Pandellé, Revue entom. France, 1899 XVIII p. 114.

Limnophora carbonella Stein, Katal. Paläark. Dipt., 1907 III p. 669.—Stein, Arch. f. Naturgesch., 1916 (1915) Abt. A Heft 10 p. 97.—Ringdahl, Ent. Tidskr., 1918 XXXIX No. 2 p. 161.

Limnophora (Spilogona) carbonella Schnabl and Dziedzicki, Abh. d. Kaiserl. Leop.-Carol. Deutsch. Akadem. Naturforsch., 1911 XCV Nr. 2 p. 154.—Karl, Tierwelt Deutschlands, 1928 Th. XIII p. 97.—Collin, Trans. Ent. Soc. London, 1930 LXXVIII Pt. 2 p. 279, pls. 18.22.

Spilogona carbonella Johnson, Occ. Papers Boston Soc. Nat. Hist., No. VII, 1925 p. 229.

RECORDS:—

1 ♂, Anchorage, Alaska, June 15, 1921; 1 ♂, Fairbanks, Alaska, June 30, 1921. (J. M. Aldrich)

This European species has been recognized by Coquillett (52) from material captured by Mrs. A. T. Slosson on Mount Washington, New Hampshire. It is doubtful whether these specimens are still in existence. I have before me two male specimens of this species, one from Sweden sent by Mr. Ringdahl, and another

from Strobl's collection belonging to Dr. A. L. Melander, together with the above two specimens collected by Dr. Aldrich in Alaska.

There are differences between the European and American specimens of this species which might be construed to be of specific importance, but the matter is a delicate one, and I feel reluctant to accord them full recognition with the limited series available.

In the European specimens there are three pairs of postsutural dorsocentral bristles (on one side of the Swedish specimen there are four postsutural dorsocentral bristles), and the halteres are blackish. In addition there are other differences, such as the arista, which has relatively long hairs for this genus, is not swollen at base, the parafacials and cheeks are no wider than the breadth of third antennal segment, the vibrissæ and abdominal bristles are noticeably robust, the hind femora have no distinctive setulose bristles on proximal half of anteroventral surface, differences which tend to accentuate the tendency to separate the specimens. On the other hand, in the Alaska specimens there are four pairs of postsutural dorsocentral bristles, the halteres are deep yellow with a trace of purplish, the arista is minutely pubescent and is decidedly swollen at base, and the cheeks are fully as high as width of third antennal segment, the vibrissæ and abdominal bristles are not noticeably robust, and the hind femur has a distinctive series of short setulose bristles on proximal half of anteroventral surface. In addition the first sternum of abdomen has a few setulæ, and the eyes a few hairs, such setulæ and hairs are lacking in the European specimens.

All the specimens agree in having the wings densely infuscated, the abdominal marks, hypopygium, and processes of fifth sternum of similar appearance, the third and fourth sterna with shorter setulæ than that on second and fifth sterna, and the legs, except for the variation on the anteroventral surface of hind femur already mentioned, with similar chaetotaxy.

The males of *carbonella* closely resemble those of *imitatrix* Malloch and *bisetosa*. From the former species the sexes may be distinguished by the vestiture on the processes of fifth abdominal sternum, and by the bristling on the postero-

ventral surface of hind femur. In *carbonella* the processes of fifth sternum have no dense series of setulæ at base adjacent the inner margin, and the hind femur has two or three short bristles on proximal half of posteroventral surface, whereas in *imitatrix* the processes of fifth sternum possess a dense series of appressed setulæ at base, and the posteroventral surface of hind femur is bare. In the males of *bisetosa* the hind femur has no bristles on proximal half of posteroventral surface, and the processes of fifth abdominal sternum have no dense series of appressed setulæ at base.

***Limnophora (Spilogona) nobilis* Stein**

Limnophora nobilis Stein, Berl. Ent. Zeitschr., 1898 (1897) XLII Heft 3 and 4 p. 207.—Coquillett, Proc. Wash. Acad. Sci., 1900 II p. 445.—Stein, Ann. Mus. Nation, Hungarici, 1904 II p. 465.—Aldrich, Misc. Coll. Smithsn. Inst., 1905 XLVI No. 1444 p. 547.—Stein, Arch. f. Naturgesch., 1919 (1917) Abt. A Heft I p. 136.—Stein, Arch. f. Naturgesch., 1920 (1918) Abt. A Heft 9 p. 47.

Melanocheilia nobilis Malloch, Canad. Ent., 1921 LIII pp. 62.63.—Malloch, N. A. Fauna, No. 46 Bur. Biol. Surv., U. S. D. A., 1923 p. 191.

RECORDS:—

Alaska, 1 ♂, 1 ♀, Katmai, July 1917. (J. S. Hine) 1 ♂, Seward, July 24, 1921; 1 ♂, 1 ♀, July 25, 1921. (J. M. Aldrich) 1 ♂, Sitka, June 16, 1899. (Harriman Exped. '99 T. Kincaid)

Washington, 1 ♂, Walkers Park, Shelton, July 21, 1917; 1 ♀, Blynn, Aug. 10, 1921; 1 ♀, Tokeland, July 18, 1917. (A. L. Melander)

The male of this species may be distinguished from many of those with eyes separated by a broad frontal vitta by the fact that the vertical bristles of head are not strongly developed. The frontal vitta is very slightly, if at all, constricted caudad; and the parafrontals are constricted to lineal dimensions at narrowest distance between the eyes, when viewed from above. In contrast to the black thorax and halteres, the wings are entirely clear and the calyptræ white. The abdomen is characteristically

marked by large blackish trapezoidal patches on dorsum of terga three and four.

The female is much paler and more pruinulent than male, though possessing the same characteristic shaped head with jet black frontal vitta. The halteres are yellowish with purplish tinge, and the anal plates of ovipositor possess short stout spines.

In both sexes the first abdominal sternum may or may not possess setulae.

It is possible that this species should be associated with the European segregate *Villeneuvea* Schnabl and Dziedzicki.

***Limnophora (Spilogona) alberta* new species**

MALE, black; head with parafacials silvery pruinulent, parafrontals with trace of brownish infuscation, cheeks not so highly pruinulent, all with dark reflections; frontal vitta black with trace of brownish pollen; frontal triangle polished; proboscis shining; antennae and palpi black. Thorax entirely blackened, including the pleura, subshining, with trace of brownish pruinulence. Abdomen with bluish gray pruinulence on cephalolateral angles of terga 3, 4, and 5; terga 1+2 entirely black, terga 3, 4, and 5 with paired black marks; hypopygium blackish, basal sclerite subshining. Legs black. Wings hyaline throughout, veins brownish. Calyptrae whitish; halteres black.

Eyes with numerous hairs, separated by a distance slightly greater than diameter of anterior ocellus, with a dense fringe of fine longish postorbital setulae; parafrontals contiguous, restricting the frontal vitta, with a dense series of fine bristles which extends caudad to a level with anterior ocellus; parafacials at base of antennae narrower than breadth of third antennal segment; cheeks at average height about equal to average breadth of third antennal segment, invaded along the ventral border by a dense series of fine upturned bristles; antennae conspicuously separated at base, third segment gradually broadened apicad, at greatest breadth slightly longer than broad; arista thickened proximad, with microscopic pubescence. Thorax with numerous fine setulae; acrosticals setulose; with four pairs of postsutural dorsocentral bristles; sternopleural bristles arranged 1:1.

Abdomen conical, with numerous fine setulae and bristles; tergum 3 with expansive, narrowly separated subtriangular marks; tergum 4 with more restricted triangular marks; tergum 5 with smaller marks, extending cephalad to margin of tergum, and becoming fused caudad; sternum 5 broadly emarginate caudad, with fine setulae and bristles.

Fore femur with a dense series of long fine bristles on posterior surface; fore tibia with no median posterior bristle, and with a weak apical postero-ventral bristle; mid femur with a dense series of fine short setulose bristles along the anteroventral surface, and a dense series of longish bristles and setulae along the ventral half of posterior surface, the bristles becoming

shorter distad; mid tibia with 1 or 2 posterior bristles: hind femur with an entire series of bristles along the anteroventral surface, those on proximal half weaker than those on distal half, posteroventral surface with a series of long fine bristles on proximal half; hind tibia with 1 anteroventral, and 1 or 2 anterodorsal bristles, with 1 or 2 obscure setulose bristles on posterior surface, with apical anterodorsal bristle setulose. Wings with costal thorns small; veins *R.* 4+5 and *M.* 1+2 gradually divergent to wing margin.

FEMALE, similar to male, largely blackish; parafacials and cheeks grayish pruinulent; parafrontals brownish infuscated; frontal vitta black, opaque; frontal triangle brownish pruinulent; proboscis subshining. Thorax, including pleura and scutellum, blackened, with paler areas adjacent humeral and notopleural callosities. Abdomen largely blackish, subshining, tergum 3 with dorsum nearly entirely black, tergum 4 with a large triangular dorsal mark, tergum 5 with a broad dorsocentral vitta, and pale grayish pruinulences. Wings hyaline: calyptrae white: halteres black.

Eyes with numerous hairs; parafacials as broad and cheeks as high as width of third antennal segment; anal plates of ovipositor with setulose hairs.

Fore tibia with no median posterior bristle: mid femur with a series of short weak bristles on proximal half of anteroventral surface, and a series of longish bristles and setulae on proximal half of posteroventral surface; mid tibia with 1 or 2 posterior bristles: hind femur with a series of anteroventral bristles, those on proximal half weaker and shorter than those on distal half, posteroventral surface with a series of bristles on proximal half; hind tibia with 1 anteroventral, and 2 anterodorsal bristles, with apical anterodorsal bristle short and weakly developed.

Length, 5.75-6.0 mm.

RECORDS:—

1 ♂, Banff, Alta., July 27, 1922; 1 ♀, June 13, 1922 (5600 ft.).
(C. B. D. Garrett) 1 ♂, Banff, Alta., June 28, 1908. (N. B. Sanson)

The species closely resembles the European species *tristiola* Zett., specimens of which have been sent to me by Mr. Ringdahl after he had examined those of *alberta*.

The species differs in that the vibrissal and oral margins do not protrude cephalad beyond a level with base of antennae, as in *tristiola*, and the eyes have more numerous hairs than in the latter species.

Type and allotype in the Canadian National Collection.

Limnophora (Spilogona) crepusculenta new species

MALE, bluish black; parafrontals, parafacials, and cheeks silvery pruinulent, with reddish black reflections; antennae and palpi black; proboscis

lightly pollinose, subshining: mesonotum of thorax, viewed from in front and above, with bluish black pruinescence and three brownish vittæ which do not extend cephalad beyond the transverse suture; scutellum entirely blackish; thoracic pleura largely blackened, concolorous with legs: abdomen with trace of bluish black pruinescence, subshining; terga 1+2 entirely black, terga 3 and 4 with black subtriangular markings which are more or less suffused across the dorsocentral plane; tergum 5 with a dorsocentral vitta and infuscation along the caudal half of tergum; basal sclerite of hypopygium lightly pollinose; processes of fifth sternum shining on distal half. Legs black, pulvilli tinged. Wings clear, tinged basad; veins brownish: calyptræ white: halteres black.

Eyes separated by a distance about equal to diameter of anterior ocellus; parafrontals contiguous; frontal vitta restricted; parafrontal bristles finely developed, continued in series caudad to about level with narrowest distance between the eyes; parafacials at base of antennæ nearly equal to breadth of third antennal segment, but little narrowed ventral; cheeks broad, in height equal to length of third antennal segment; antennæ relatively widely interspaced, second segment three-quarters as long as third segment; arista almost bare, thickened on basal third. Thorax with presutural acrosticals setulose, sparsely set; with four pairs of postsutural dorsocentral bristles; sternopleural bristles arranged 1:1.

Abdomen with markings on terga 3 and 4 subtriangular, expansive, those on tergum 4 smaller than those on tergum 3; the paired nature of the markings more or less obscured owing to heavy infuscation covering the interspaces; basal sclerite of hypopygium with numerous fine bristles; fifth sternum deeply emarginate, with a few fine setulae.

Fore tibia with no median posterior bristle, with a fine apical posteroventral bristle: mid femur with a series of short fine bristles on proximal third of anteroventral surface, and with a series of bristles on proximal two-thirds of posteroventral surface; mid tibia with 2 posterior bristles: hind femur with a complete series of anteroventral bristles, and a series of fine long bristles on proximal half of posteroventral surface; hind tibia with 2 anteroventral, and 2 anterodorsal bristles, the posterior weak bristles not evident, apical anterodorsal bristle setulose. Wings with veins *R.* 4+5 and *M.* 1+2 nearly subparallel to wing margin; *m-cu* cross vein erect; costal thorn fine but well developed.

Length, 5.5 mm.

RECORD:—

1 ♂, Lake Naknek, Savonoski, Alaska, July 1919. (J. S. Hine)

Type in the collection of Professor J. S. Hine, Columbus, Ohio.

The males of this and the following species may be recognized by the characteristic appearance of thorax and abdomen. The mesonotum has a bluish black caste to the pruinescence, whilst

the pleura are contrastingly deep black; the halteres are blackened. The abdomen in both species is similar to that of *nobilis*, especially in regard to the shape of tergal marks. The males of *crepusculenta* differ from those of *comata* (p. 146) in that the thoracic vittæ do not continue cephalad of transverse suture.

***Limnophora (Spilogona) comata* new species**

MALE.—Parafrontals, parafacials, and cheeks silvery pruinose with dark reflections; antennæ and palpi black; frontal triangle polished; proboscis lightly pollinose. Thorax with mesonotum grayish pruinose, paler on humeral and notopleural callosities; with three brownish vittæ on presutural and postsutural areas; scutellum blackish; pleura blackened, notably on the mesopleural area. Abdomen grayish pruinose, with large expansive black marks on terga 1+2, 3, and 4, all of which coalesce more or less across the dorsocentral plane owing to brownish infuscation; tergum 5 with a conspicuous dorsocentral infuscation: basal sclerite of hypopygium grayish pollinose. Wings faintly tinged, more noticeably basad: calyptræ whitish: halteres blackened.

Eyes separated by a distance about as broad as that of third antennal segment; parafrontals almost contiguous at apex of frontal triangle; parafrontal bristles continued in series caudad to a level with apex of frontal triangle; parafacials at base of antennæ about as wide as breadth of third antennal segment; cheeks slightly higher than width of third antennal segment, well maintained caudad; third antennal segment about 1.75 times as long as broad; arista minutely pubescent.

Thorax with presutural acrosticals in two series, composed of 3 or 4 irregular pairs, setulose; with four pairs of postsutural dorsocentral bristles; sternopleural bristles arranged 1:2.

Abdomen conical, with numerous fine longish bristles on caudal half of tergum 5 and on basal sclerite of hypopygium; terga 1+2 entirely blackish, tergum 3 with trapezoidal marks, tergum 4 with a similar but smaller marking, the blackish area along the cephalic margin much more restricted than on tergum 3, tergum 5 with an ill defined dorsocentral infuscation.

Fore tibia with no median posterior bristle, with apical posteroventral weak: mid femur with a series of 3 or 4 setulose bristles on basal third of anteroventral surface, with a series of longish bristles on proximal half of posteroventral surface; mid tibia with 2 posterior bristles: hind femur with a series of 4 or 5 bristles on distal half and 2 or 3 setulose bristles on proximal third of anteroventral surface, with 2 or 3 bristles on proximal third of posteroventral surface; hind tibia with 2 anteroventral, and 2 or 3 anterodorsal bristles, with no apparent weaker bristles on posterior surface, apical anterodorsal bristle setulose. Wings with veins *R.* 4+5 and *M.* 1+2 subparallel to wing margin; *m-cu* cross vein erect. Length 4.75 mm.

FEMALE, paler in color than male: parafrontals grayish with trace of brownish infuscation; parafacials and cheeks grayish; frontal triangle and

proboscis pollinose. Thorax grayish pruinose, opaque, with more or less brownish infuscation along the discal area of mesonotum, at basal angles of scutellum, and on mesopleura; thoracic vittæ obscured. Abdomen grayish pruinose, with distinctly separated brownish marks on terga 1+2, 3, and 4; tergum 5 with at most a trace of light brownish infuscation along the dorsocentral plane. Legs grayish black. Wings clear; calyptræ whitish; halteres deep yellow with more or less trace of purplish or blackish tinge.

Parafrontals with a few setulæ; parafacials at base of antennæ broader and cheeks higher than width of third antennal segment. Thorax with sternopleural bristles arranged 1:1. Abdomen with large subtriangular marks on terga 3 and 4; ovipositor with spinules on anal plates.

Fore tibia with no median posterior bristle: mid femur with no anteroventral bristles, with a series of bristles on proximal half of posteroventral surface; mid tibia with or without a short anterodorsal bristle, with 3 or 4 posterior bristles; hind femur and hind tibia with similar chaetotaxy as in male. Wings with costal thorns well developed; veins *R.* 4+5 and *M.* 1+2 gradually divergent towards wing margin; *m-cu* cross vein slightly sinuate, erect.

Length, 5.0-5.5 mm.

Type and allotype in the collection of Professor J. S. Hine, Columbus, Ohio.

RECORDS :—

1 ♂, 1 ♀, Katmai, Alaska, Aug. 1917; 2 ♀, Naknek Lake, Savonoski, Alaska, Aug. 1, 1919; 1 ♀, Aug. 1919. (J. S. Hine)

According to the male sex the species is most closely allied to *crepusculenta* from which it differs most noticeably in the form of the head and the extent of the thoracic vittæ as indicated in the key. The female of *comata* possesses a characteristic brownish infuscation along the median third of dorsum of thorax, and the ovipositor has a few stout spinules on anal plates.

Limnophora (*Spilogona*) *nigriventris* (Zetterstedt)

Aricia nigriventris Zetterstedt, Dipt. Scand., 1845 IV p. 1442.

Limnophora nigriventris Stein, Wien Entom. Zeitg., 1902 XXI p. 37.—Stein, Katalog Paläark. Dipt., 1907 III p. 672.—Stein, Arch. f. Naturgesch., 1914 (1913) Abt. A Heft 8 p. 28.—Stein, Arch. f. Naturgesch., 1916 (1915) Abt. A Heft 10 p. 105.—Ringdahl, Entom. Tidskr., 1918 XXXIX Häft 2 p. 174, 179

Limnophora monticola Malloch, Trans. Amer. Ent. Soc., 1920 XLVI No. 802 p. 152.

Melanochelia monticola Malloch, Canad. Ent., 1921 LIII p. 62.

Spilogona monticola Johnson, Occ. Pap. Boston Soc. Nat. Hist., No. VII, 1925 p. 229.

RECORDS:—

4 ♂, White Mountains, (N. H.) no date (Morrison); 1 ♂, Mt. Washington, N. H., July 8, 1914; 2 ♀, at 2500 ft. July 24, 1915; 1 ♀, Glen House, N. H., July 15, 1915. (C. W. Johnson)

It was only when I saw the female of this species that I felt assured as to its true identity. In this sex the species is clearly defined, possessing the following strong characters. Frontal triangle polished; abdomen entirely blackish and glossy, in contrast the thorax is cinereous gray, pruinose; wings with cross veins densely clouded, costal thorn strongly developed. In addition the ovipositor has setulose hairs only on anal plates. The male superficially resembles the female in most of the above respects, differing in degree in that the abdomen has traces of pruinescence and indications of paired markings; the costal thorn is not so strongly developed, and the cross veins not so densely infuscated. In addition the hind femur possesses a series of 3 or 4 short bristly hairs on proximal half of posteroventral surface, which on account of their fine development may not be readily discerned, nor rightly evaluated.

In both sexes the scutellum has a few appressed setulose hairs on dorsal margin of lateral declivities adjacent the apical bristles, and the hind femur has the distal (preapical) bristle of the anterodorsal series situated at a markedly lower plane than those constituting the remainder of the series.

Limnophora (*Spilogona*) *arenosa* Ringdahl

Limnophora arenosa Ringdahl, Ent. Tidskr., 1918 XXXIX Haft 2 p. 155.

RECORDS:—

Alaska, 1 ♂, Naknek Lake, Savonoski, July 27, 1919. (J. S. Hine) 1 ♂, Anchorage, June 13, 1921. (J. M. Aldrich)
Montana, 1 ♂, Gallatin Mts., July 7, 1914. (5000 ft.)

Wyoming, 1 ♂, N. W. entrance, Yellowstone Park, Aug. 3, 1918. (A. L. Melander)

This species was described by Ringdahl from specimens captured in Lapland, and has hitherto not been recorded from North America.

The male specimen from the Gallatin Mountains, Montana, was sent to Mr. Ringdahl for examination, and he reported that he could find no external characters that would, in his opinion, justify its separation from *arenosa*.

There is a considerable degree of variation in the form of the abdominal marks in the above specimens, especially between those collected in Alaska and those in the Gallatin Mountains and the Yellowstone Park, but I am reluctant to believe that there is more than one species represented. In the case of the specimen from Anchorage, Alaska, the abdominal marks are more closely approximated on terga three and four, those on tergum three being trapezoidal, and those on tergum four smaller and subtriangular in outline. In both cases the inner margins are parallel. In the other specimens the abdominal marks on terga three and four are relatively smaller in area, are subequal, and are subtriangular in outline, the inner margins being slightly divergent cephalad. In addition, the Alaska specimens have the eyes more widely separated than in the remaining specimens.

All agree in having the characteristic foreshortening of the sublateral vittæ on mesonotum at the transverse suture, thereby restricting the number of vittæ on the presutural area to one, in having the contrasting blackish reflection of the scutellum with the bluish gray pruinescence of the mesonotum, in having a few setulose hairs on dorsal margin of lateral declivities of scutellum adjacent the apical bristles, in possessing two or three relatively fine longish bristles along apical margin of processes of sternum five, and by the rather short distal section of the proboscis which is polished at base but densely pollinose for the remainder of the surface.

The males of the species resemble most closely those of *denudata*, from which it may be distinguished by the possession of only the median vitta on presutural area of mesonotum,

whereas in *denudata* there are three narrow brownish vittæ on presutural area. The poor condition of the specimen representing *denudata*, the identity of which has been very kindly verified by Mr. J. E. Collin, precludes a further comparison between the species from being made.

***Limnophora (Spilogona) argentiventris* Malloch**

Limnophora argentiventris Malloch, Trans. Amer. Ent. Soc., 1920 XLVI No. 802 p. 149.

Melanochelia argentiventris Malloch, Canad. Ent., 1921 LIII p. 62.

RECORD:—

1 ♂, Sioux City, Iowa, May 6, 1918, taken at light. (C. N. Ainslie)

The above specimen agrees in every particular with the description of the type and the diagnostic characters given in Malloch's key, in that the abdomen in the male is densely whitish pruinulent, with no marks on the third visible tergum (tergum 4).

There is a large series of specimens before me from the Rocky Mountains which, in my opinion, belongs to this species, varying only in that the abdomen in the male has a pair of smaller blackish spots on tergum four as well as on tergum three. There are also minor differences in the shape of certain structures comprising the male genitalic appendages. I have not been able to see the type which is in the collection of the Biological Survey of the United States Department of Agriculture.

***Limnophora (Spilogona) argentiventris* var. *occidentalis*, new variety**

Similar in structure to *argentiventris* Malloch, differing essentially in the male in that the abdomen possesses a pair of small blackish spots on tergum three and four. Specimens from Colorado and New Mexico have a distinct brownish interrupted dorsocentral vitta between the abdominal marks, and on tergum five. In male specimens from Washington and British Columbia the dorsocentral vitta is indistinct, being evident in most specimens on tergum five only. There is a considerable variation in the width of parafacials and height of cheeks when viewed in profile. The eyes are relatively large, and in a number of specimens extend well forward to the parafacials and deep into the cheeks, resembling in this respect species of the genus *Gymnodia*. All the male specimens agree in the chaetotaxy of the thorax, the armature of the legs, and in the characteristic shape of the

processes of fifth abdominal sternum. The latter is a relatively long sclerite with a shallow emargination caudad. The processes become sharply attenuated apicad, being largely blackened and shining in appearance.

In the female the abdomen has small brownish spots on terga three and four, and a brownish dorsocentral vitta more or less evident when viewed from behind. The anal plates of ovipositor possess fine setulæ.

Type, allotype, and paratypes in the United States National Museum.

RECORDS:—

British Columbia, 1 ♂, Oliver, May 2, 1923; 1 ♂, May 4, 1923; 1 ♂, May 5, 1923; 1 ♂, May 16, 1923; 1 ♀, April 27, 1923. (C. B. D. Garrett) 1 ♂, 3 ♀, Fairmont, July 28, 1926. (A. A. Dennys)

Alberta, 5 ♀, Banff, Aug. 21, 1922. (C. B. D. Garrett)

Washington, 5 ♂, 5 ♀, Medical Lake, July 14, 1920; 1 ♂, 1 ♀, Lake Paha, June 20, 1920; 4 ♀, Coulee City, Sept. 3 1920. (R. C. Shannon) 1 ♂, Pateros, Aug. 3, 1919. (A. L. Melander) 1 ♂, Oroville, (no date). (Coquillett)

Wyoming, 1 ♂, Caso Firehole R., Yellowstone Park, Aug. 18, 1918; 1 ♀, Canyon Camp, Yellowstone Park, (no date). (A. L. Melander) 1 ♀, Yellowstone Park, July 25, 1916, elev. 7394 ft. (Mont. Exp. Sta.)

Colorado, 4 ♂, 4 ♀, Colo. 1527; 1 ♀, 1563; 1 ♂, 1 ♀, 1576. (Coquillett)

Nevada, 1 ♂, Ormsby Co., July '6, —. (Baker)

New Mexico, 2 ♂, 1 ♀, Socorro, (no date). (S. W. Williston)

Limnophora (Spilogona) cretans new species

MALE, grayish; parafrontals, parafacials, and cheeks silvery pruinulent; frontal triangle whitish pruinulent; frontal vitta black with whitish pollen; antennæ and palpi black; proboscis polished. Thorax grayish black, lightly pruinulent, with two darkish streaks along the dorsocentral plane; scutellum entirely gray. Abdomen densely grayish pruinulent, with a brownish caste; terga 1+2 with dark reflections on cephalic half; terga 3 and 4 with two small brownish black marks; with trace of a dorsocentral dark streak on all segments; fifth sternum thinly pollinose, blackish, subshining. Legs blackish, pulvilli tinged. Wings clear, veins yellowish brown; calyptæ whitish; halteres yellow.

Eyes separated by a distance about equal to length of third antennal segment; frontal vitta but little narrower caudad, distinctly separating the parafrontals throughout their entire length; parafrontals in profile noticeably raised above margin of eye; parafacials at base of antennæ broader and cheeks ventrad of eye higher than width of third antennal segment;

parafrontal, ocellar, and vertical bristles stoutly developed; vibrissal angle with numerous stout coarse setulæ; third antennal segment small, narrow, but little longer than second segment, the latter with several coarse setulæ; arista minutely pubescent.

Thorax with stoutly developed bristles, with four pairs of postsutural dorsocentral bristles; presutural acrostical bristles in two closely adjacent series, and much stronger developed than the adjacent setulæ, bristlelike; sternopleural bristles arranged 1:2.

Abdomen cylindrical, gradually narrowing caudad; tergum 3 with small, widely separated, subtriangular marks; tergum 4 with marks smaller and less definitely shaped, confined to posterior half of tergum; fifth sternum with a broad, shallow emargination; sternum 2, 3, and 4 with a pair of well developed bristles adjacent caudal margin.

Fore tibia with 1 median posterior bristle: mid femur with a few weak bristles on proximal third of anteroventral surface, with a series of bristles on proximal half of posteroventral surface; mid tibia with no anterodorsal bristle, with 2 posterior bristles; hind femur with 2 or 3 anteroventral bristles, and 1 or 2 posteroventral bristles; hind tibia with 2 anteroventral, and 1 robust anterodorsal bristle, and with 1 weaker bristle on posterior surface. Wings with veins *R.* 4+5 and *M.* 1+2 divergent towards wing margin.

Length, 5 mm.

FEMALE, similar in color to male; thorax with no apparent vittae; scutellum entirely gray: abdomen largely discolored, making it difficult to detect markings, but with apparently brownish areas on terga 3 and 4; halteres yellow. Macrochaetæ of head and thorax stoutly developed; parafrontals with numerous setulæ. Abdominal bristles short and weakly developed; ovipositor with fine setulæ on anal plates.

Fore tibia with 1 median posterior bristle: mid femur with 2 or 3 bristles on proximal half of posteroventral surface; mid tibia with 2 posterior bristles: hind femur with 1 or 2 bristles on distal third of anteroventral surface, and with 1 or 2 weak bristles on proximal third of posteroventral surface; hind tibia with 2 anteroventral, and 1 robust anterodorsal bristle, and with 1 weaker bristle on posterior surface.

Length, 5.25 mm.

RECORDS:—

1 ♂, Chin, Alberta, May 30, 1923; 3 ♂, 1 ♀, June 7, 1923.

(H. L. Seamans) Type in Canadian National Collection.

The species most closely resembles *brevicornis* Malloch, differing essentially in that the hind femur possesses one or two posteroventral bristles on proximal third, and the hind tibia has only one median anterodorsal bristle, whereas in *brevicornis* the posteroventral surface of hind femur is without bristles on

proximal third, and the hind tibia has two or more anterodorsal bristles. In addition, the male abdominal marks of *cretans* are smaller and not so sharply defined as in *brevicornis*, and in the female of *cretans* the ovipositor has fine setulæ on anal plates, whereas in *brevicornis* the anal plates possess stout short spines.

***Limnophora (Spilogona) rufitarsis* Stein**

Limnophora rufitarsis Stein, Arch. f. Naturgesch., 1920 (1918)
Abt. A Heft 9 pp. 46.51.

RECORDS:—

Alaska, 1 ♂, Naknek Lake, Savonoski, Aug. 14, 1919; 1 ♀, July 31, 1919. (J. S. Hine)

Alberta, 1 ♂, Waterton, Aug. 4, 1924; 1 ♀, Aug. 13, 1922. (H. L. Seamans) 1 ♂, Jasper, July 25, 1923. (J. McDunnough)

Washington, 1 ♀, Chehalis, Aug. 25, 1911; 9 ♂, 3 ♀, Tacoma, Aug. 27, 1911. (A. L. Melander)

Oregon, 1 ♂, Hood Rapids, Mt. Hood, July 29, 1921. (A. L. Melander)

The species was described from Washington, and is evidently western in its distribution. The species is peculiar in that the fore tarsi at least are typically yellowish. In the above series of specimens there is a considerable degree of variation in the coloration of tarsi and tibiæ, both in males and females. In certain specimens the tarsi and tibiæ appear largely yellowish whilst in others they are largely blackish.

In the male the eyes are broadly separated by a narrow frontal vitta, the latter being as broad as width of third antennal segment; the ocellar and inner pair of vertical bristles are strongly developed, bristlelike; the buccal and vibrissal areas have only one or two setulæ adjoining the bristles; the mesonotum and abdomen are densely grayish pollinose, the former with a brownish median vitta, and the latter with deep seal brown, widely separated, marks on terga three and four. In certain specimens there may be a brownish dorsocentral vitta between the marks on terga three and four. The scutellum is densely grayish pollinose with traces of darker areas at basal angles. The calyptreæ are yellowish.

The species superficially resembles *suspecta* Malloch, but that species has three pairs of dorsocentral bristles caudad of the transverse suture, and the eyes in the male are not so widely separated as in *rufitarsis*.

***Limnophora (Spilogona) placida* new species**

MALE, pale grayish with brownish markings; head with parafrontals, parafacials, and cheeks silvery pruinose; frontal vitta, viewed from below, with whitish pollen; frontal triangle and proboscis polished; antennæ and palpi black. Thorax grayish pruinose, with three narrow vittæ; scutellum largely grayish white, with trace of brownish areas at basal angles; mesopleura entirely grayish. Abdomen with dense pale grayish pruinose, opaque, with paired brownish marks on terga 1+2, 3, and 4, those on the fifth tergum not well defined; basal sclerite of hypopygium whitish gray pollinose. Legs grayish black, tarsi brownish tinged. Wings clear; calyptre whitish; halteres deep yellow.

Eyes separated by a distance not greater than breadth of third antennal segment; parafrontals contiguous cephalad of ocellus; parafrontals with at most weak bristles on caudal half; parafacials at base of antennæ about equal to width of third antennal segment; cheeks slightly higher than breadth of third antennal segment, with a series of sparsely set setulæ and bristles along ventral border. Thorax with presutural acrosticals setulose, with four pairs of postsutural dorsocentral bristles; sternopleural bristles arranged 1:2. Abdomen cylindrico-conical, each tergum except the fifth with paired markings, those on terga 1+2 not well defined and more or less distinctly separated, those on terga 3 and 4 subequal in size, subtriangular in shape, the inner margins slightly divergent cephalad, markings on tergum 5 not well defined: first sternum with a few setulæ, fifth sternum deeply emarginate, with short bristles on apical region of processes.

Fore tibia with no median posterior bristle, with a weak apical posteroventral bristle: mid femur with at most 1 or 2 weak bristles on proximal third of posteroventral surface, with a series of posteroventral setulæ, the setulæ gradually increasing in length apicad; mid tibia with or without an anterodorsal bristle, with 2 posterior bristles: hind femur with 3 or 4 bristles on distal half of anteroventral surface, with 2 or 3 weak bristles, irregularly placed, at base of posteroventral surface; hind tibia with 1 or 2 anteroventral, and 2 anterodorsal bristles, with or without 1 or 2 weaker bristles on posterior surface. Wings with veins *R.* 4+5 and *M.* 1+2 slightly divergent towards wing margin, *m-cu* cross vein erect.

FEMALE, similar to male; head grayish white pruinose; parafrontals with brownish infuscation along border of frontal vitta; frontal triangle brownish pollinose. Thorax with three broader brownish vittæ, and in addition two lateral vittæ that are not so well defined; scutellum with brownish areas at basal angles. Abdomen with brownish dorsocentral vitta on tergum five.

Parafrontals with a few setulæ; parafacials at base of antennæ fully as wide as breadth of third antennal segment; cheeks higher than greatest breadth of parafacial. Abdomen with markings as in male, except that terga 1+2 are largely grayish pruinose, and the fifth tergum has a more distinctive dorsocentral vitta: ovipositor with spinules on anal plates.

Fore tibia with no median posterior bristle: mid femur with no bristles on posterior surface; mid tibia with or without a weak anterodorsal bristle, with 2 posterior bristles: hind femur with 3 or 4 anteroventral bristles on distal half, and 2 or 3 fine setulose bristles at base of posteroventral surface; hind tibia with 1 or 2 anteroventral, and 2 anterodorsal bristles, with or without 1 or 2 weak bristles on posterior surface.

Length, 5.5 mm.

RECORDS :—

Alaska, 1 ♂, Katmai, Aug. 1917; 1 ♀, Naknek Lake, Savonoski, July '19; 1 ♀, July 28, 1919; 1 ♀, July 31, 1919. (J. S. Hine)

Colorado, 1 ♂, Tennessee Pass, 10240 ft. July 9, —; 1 ♂, July 12, —. (J. M. Aldrich)

New Hampshire, 1 ♂, White Mts., no date. (Morrison)

Type and allotype in the collection of Professor J. S. Hine, Columbus, Ohio.

This species most closely resembles *arenosa* Ringdahl in being pale gray in color with noticeable vittæ and markings on thorax and abdomen respectively. However the species possesses a number of significant characters which should aid in its recognition. The thorax has four pairs of postsutural dorsocentral bristles; the first abdominal sternum has a few setulæ; the mid and hind femora have only 2 or 3 fine setulose bristles at base of posteroventral surface; the ovipositor of female is armed with spinules on anal plates. In addition the pleura are concolorous with mesonotum, and the halteres are yellowish in *placida*, whereas in *arenosa* and *comata* the pleura and halteres are largely darkened.

Limnophora (*Spilogona*) *setinervis* new species

MALE, blackish; parafrontals and parafacials deep velvety grayish pruinose, with a brownish black sheen at fusion of parafacials with buccæ; cheeks more lightly pruinose, with dark reflections; frontal vitta black, when viewed from below with trace of brownish pruinescence; frontal triangle and proboscis lightly pollinose; antennæ and palpi black. Thorax blackish, subshining, with trace of darker vittæ; humeral and noto-

pleural areas strikingly bluish gray pruinose; scutellum entirely black; pleura largely blackish. Abdomen with cinereous gray pruinescence at cephalolateral angles of terga 3, 4, and 5; terga 1+2 entirely blackish, terga 3, 4, and 5 with paired black marks confined to dorsum, the markings more or less obscurely separated owing to infuscation on the intervening area; hypopygium, including the basal sclerite and fifth sternum, blackish, subshining. Legs blackish, pulvilli tinged. Wings smoky, slightly infuscated basad; calyptæ tinged; halteres yellow.

Eyes separated by a distance greater than width of third antennal segment; parafrontal bristles continued in series caudad to a level with anterior ocellus; frontal vitta only slightly narrowed caudad, parafrontals distinctly separated throughout; parafacials slightly wider than average breadth of third antennal segment, but little narrowed ventrad; cheeks broad, well maintained caudad, in height about equal to length of third antennal segment, with a series of longish bristles and fine setulæ along ventral margin; third antennal segment slightly tapered apicad.

Thorax with presutural acrosticals setulose, with four pairs of postsutural dorsocentral bristles; sternopleural bristles arranged 1:2.

Abdomen cylindrical; markings on tergum 3 trapezoidal, on tergum 4 subtriangular, smaller and more constricted cephalad than marks on tergum 3, on tergum 5 obscurely subtriangular, smaller than those on tergum 4; fifth sternum deeply incised; processes broadly rounded, with fine longish setulæ and bristles, which become longer apicad; sterna 2, 3, and 4 with numerous long bristles.

Fore tibia with or without a median posterior bristle: mid femur with a series of fine short bristles on anteroventral surface, the bristles of which become more setulose and appressed distad, posteroventral surface with a series of bristles on proximal two-thirds; mid tibia with 1 or 2 anterodorsal, and 2 or 3 posterior bristles: hind femur with a series of 3 to 5 strong bristles on distal half of anteroventral surface, and, in contrast, with a series of short fine setulose bristles on proximal half, with a series of bristles on proximal half of posteroventral surface; hind tibia with 4 anterventral, 2 or 3 anterodorsal bristles, and with 2 weaker posterior bristles. All tarsi slender, longer than their respective femur; pulvilli large.

Wings with veins *R.* 4+5 and *M.* 1+2 divergent at wing margin, *m-cu* cross vein erect; costal setulæ well developed but not long; auxiliary vein with one or more setulæ on under surface proximad of humeral cross vein.

FEMALE, paler in color than male; parafrontals infuscated; proboscis pollinose; mesonotum as in male, blackish infuscated with trace of vittae; humeral and notopleural callosities strikingly bluish gray pruinose; scutellum grayish with brownish marks at basal angles. Abdomen grayish, lightly pruinose, abdominal marks brownish, less intensive than in male; terga 1+2 largely brownish, terga 3 and 4 with widely separated brownish subtriangular marks on dorsum, tergum 5 with a dorsocentral vitta; in addition terga 3, 4, and 5 have trace of brownish marks on venter. Wings hyaline, faintly tinged basad; calyptæ yellowish; halteres yellow.

Parafrontals with numerous setulæ; ovipositor with fine setulæ on anal plates.

Fore tibia with or without a median posterior bristle: mid femur with a series of bristles on proximal half of posteroventral surface; mid tibia with 2 or 3 anterodorsal, and 2 or 3 posterior bristles: hind femur with a series of 4 bristles on distal half, and 2 or 3 setulose bristles on proximal third of anteroventral surface, and with a series of 2 to 4 fine short bristles on proximal third of posteroventral surface; hind tibia with 3 or 4 anteroventral, and 3 anterodorsal bristles, and with 2 or 3 setulose bristles on posterior surface. Tarsi slender, longer than their respective femur; pulvilli small. Auxiliary vein, as in male, with one or more setulæ on under surface proximad of humeral cross vein.

Length, 6.5 mm.

RECORDS:—

- 1 ♂, 1 ♀, Yakutat, Alaska, June 21, 1899. (Harriman Exp. '99. T. Kincaid) 1 ♀, Bonne Esperance, Que., July 14, 1929. (W. J. Brown)

Type and allotype in United States National Museum.

The species may be readily separated from any other North American species known to me by the presence of one or more fine setulæ on the under surface of the auxiliary vein proximad of humeral cross vein. The mesonotum has the humeral and notopleural callosities strikingly pale bluish gray pruinose in contrast to the darker infuscation of the discal area.

The parafacials in the male are noteworthy for the fact that the region adjoining the buccal area of cheek is characteristically occupied by a darkened patch or reflection in the pruinescence, and in the female the abdominal terga are peculiar in that each possesses a pair of accessory brownish marks on ventral surface in addition to the paired marks on dorsum.

Limnophora (Spilogona) compuncta (Wiedemann)

Anthomyia compuncta Wiedemann, Zoolog. Mag., 1817 I p. 80.—Meigen, Syst. Besch., 1826 V p. 147.—Walker, List Dipt. Brit. Mus., 1849 IV p. 943.

Limnophora compuncta Macquart, Hist. Nat. d. Ins., 1835 II p. 311.—Schiner, Fauna Austr., 1862 I p. 622.—Rondani, Della Soc. Ital. Scienze Naturali, 1866 IX p. 138.—Rondani, Dipt. Ital. Prodr., 1877 VI pp. 11.106.—Meade, Ent. Month. Mag., 1878 XIV p. 251.—Meade, Ent. Month. Mag., 1881 XVIII p. 101.—Strobl, Verh. zool.-bot. Gesell. Wien, 1894 (1893) XLIII

- p. 225.—Coquillett, Diptera of the Commander Islands, 1899
p. 344.—Aldrich, Misc. Coll. Smiths. Institut., 1905 XLVI
No. 1444 p. 546.—Stein, Katalog Paläark. Dipt., 1907 III p.
670.—Stein, Arch. f. Naturgesch., 1914 (1913) Abt. A Heft 8
p. 28.—Stein, Arch. f. Naturgesch., 1916 (1915) Abt. A Heft
10 p. 97.—Ringdahl, Ent. Tidskr., 1918 XXXIX p. 171.
Aricia compuncta Zetterstedt, Dipt. Scand., 1845 IV p. 1457.—
Zetterstedt, Dipt. Scand., 1849 VIII p. 3284.—Zetterstedt,
Dipt. Scand., 1860 XIV p. 6216.
Spilogaster compuncta Meade, Descr. List Brit. Anth., 1897 I
p. 23.
Aricia (Limnophora) compuncta Pandellé, Revue entom. France,
1899 XVIII p. 125.

(To be Continued)

ARE ECONOMIC ENTOMOLOGISTS BECOMING "INSECTICIDE MINDED?"

BY ALVAH PETERSON
OHIO STATE UNIVERSITY

The author submitted to the North Central Entomologists for their 1931 meeting at Urbana, Illinois, a topic similar to the title of this article. It aroused considerable discussion and debate. Since that meeting the author has made further inquiry into this question. There are at least two sources from which one can obtain data which will show the extent of the insecticide point of view of economic entomologists. If one studies the budgets of various entomological institutions in the United States one may learn from these the extent of the insecticide work. By this study one can ascertain the extent of the insecticide work now in progress but it is difficult to ascertain from past budgets what the extent of the insecticide work was 15 to 20 years ago. The author soon learned by correspondence and visits that it would require a great deal of time, personal visits and considerable money to get facts from the budgets which would show the status of insecticide work over a period of 15 to 20 years from a number of institutions. The little information he was able to assemble from such a study indicated strongly that much more insecticide work is in progress to-day than was the case 15 to 20 years ago.

The second method employed was a careful examination of the contents of the entomological literature appearing in the various important journals and in federal and state experiment station bulletins and reports. Such an examination should give a picture of an economic entomologists's point of view and undoubtedly is a good criterion of what they have done and are doing. The author selected for detailed analysis the *Journal of Economic Entomology* and the *Review of Applied Entomology*, Series A.

In the *Journal of Economic Entomology*, the author counted and assembled the insecticide papers at five-year intervals for

the following years: 1909-1911, 1914-1916, 1919-1921, 1924-1926, and 1929-1931. Table I shows the results and it will be

TABLE I

TABLE SHOWING PERCENTAGE OF PAPERS DEALING WITH INSECTICIDES AND BIOLOGICAL CONTROL PUBLISHED IN THE JOURNAL OF ECONOMIC ENTOMOLOGY AND ABSTRACTED IN THE REVIEW OF APPLIED ENTOMOLOGY, SERIES A.

Jour. Econ. Entomology. Five year intervals—(three year periods)	1909-11	1914-16	1919-21	1924-26	1929-31
Insecticide papers	17	15	23	33	32
Biological control papers	7	11	4	7	8
Review of Applied Entomology Series A. Five year intervals					
		1915	1920	1925	1930
Insecticide papers		17	16	28	29
Biological control papers		15	8	9	10

noted that the percentage of insecticide papers appearing from 1924 to date is twice as great (32-33 per cent.) as the percentage appearing from 1909-1916 (15-17 per cent.). It may be argued by some that the Journal of Economic Entomology does not truly represent the work of an economic entomologist because practically all insecticide papers appear in this Journal, while biological papers would be published elsewhere. To answer this argument the author examined the contents of all entomological papers from the United States that were abstracted and reviewed in the Review of Applied Entomology, Series A, for the years 1915, 1920, 1925, 1930. Table I shows conclusively that during the years 1925 and 1930 the percentage of insecticide papers was nearly twice (28 and 29 per cent.) that for 1915 and 1920 (17 and 16 per cent.). Table II totals all the insecticide papers from the United States abstracted for the above years in the Review of Applied Entomology, Series A. The total numbers of papers of economic interest during the past 5 to 7 years is 1.3 times greater than 12 to 17 years ago, but the insecticide

TABLE II

TABLE SHOWING THE TOTAL NUMBER OF INSECTICIDE AND BIOLOGICAL CONTROL PAPERS COMING FROM THE UNITED STATES ABSTRACTED IN THE REVIEW OF APPLIED ENTOMOLOGY, SERIES A., FOR 1915, 1920, 1925 AND 1930

Year and Publications	1915	1920	1925	1930	Ratio of 1915-1920 to 1925-1930
Total number of all papers	455	368	462	620	1: 1.3
Insecticide papers	80	60	132	185	1: 2.2
Papers with insecticide notes	52	64	55	63	1: 1
Both	132	124	187	248	1: 1.7
Biological control papers	72	30	45	67	1: 1.1
Papers with Biological control notes	59	40	37	32	1: .7
Both	131	70	82	99	1: .9

papers are 2.2 times greater. It will also be noted that the number of papers containing miscellaneous insecticide notes and discussion show little or no increase. This decided increase in the percentage of insecticide papers must be significant. Undoubtedly economic entomologists are more "insecticide minded" than they were 15 to 20 years ago.

In conversing with entomologists in general one gains the impression that to-day we are conducting much more research along fundamental biological lines than in the past. Some work of this character is going on at all times, yet the percentage probably is no greater than it was a number of years ago, at least this appears to be true in the field of biological control. Since the author is primarily interested in biological control (natural enemies of insects) he has examined the literature to see the extent and nature of the research work conducted in this field. The percentage of papers that appeared on biological control 15 to 20 years ago is as great or greater than what has appeared during the past 5 to 7 years (Tables I and II). Also the number and percentage of biological control papers 15 to 20

years ago was approximately equal to those dealing with insecticides. If our publications indicate the trend of economic entomology, then the percentage of entomological work in biological control to-day is little or no greater than it was 15 to 20 years ago.

Forty to fifty years ago entomologists were chiefly concerned with taxonomy, morphology, and the development of insects. About that time a few investigators commenced to think of insect control from an insecticide angle. Since then insecticide control has grown rapidly and to-day it dominates economic entomology. Early in the history of economic entomology entomologists with a smattering of chemical knowledge developed some of our common and most useful insecticides. By their shotgun method and a hit and miss system of study they stumbled onto a few very useful substances. Many of these to-day are still our most important insecticides. During the past ten years comparatively few important products have been added to the list by entomologists. As the development of new insecticides continues are we not rapidly approaching the day when the discovery of new chemicals, useful as insecticides, will be brought about exclusively by chemists and physicists who are equipped to develop useful, synthetic products? Probably before long most insecticide entomologists of necessity will be routine testers, or pseudo-chemists, observing the results obtained with products A, B and C, which are "brain children" of chemists and physicists.

Past and present day circumstances demand immediate answers to our problems, consequently entomologists have been forced to think of control largely in terms of chemicals. Present day insecticide demands are greater than those of a few years ago because many chemists and large chemical corporations are very much interested in insecticides. When influential groups of chemically minded individuals demand help from entomologists they receive attention where less influential groups of individuals or points of view sponsored by no group in particular get little attention. An economic entomologist soon finds that he is spending a great deal of time and thought upon insecticides. If an entomologist continues in an insecticide environ-

ment for a prolonged period he gradually reaches the stage where he thinks of insect control almost exclusively from an insecticide point of view. Some of our colleagues in charge of entomological research projects and institutions apparently have reached this stage and, as a consequence, have a decidedly warped point of view of economic entomology. After all is said and done, isn't an entomologist supposed to be a biological scientist who knows his insects? If such is the case, some of our economic "insecticide" entomologists are fundamentally no longer real entomologists. The insecticide fog in which they are completely submerged prevents their seeing the possibilities for control in the fields of ecological and biotic relationships.

At this point the author cannot refrain from making the following statement even though he does not intend to discuss the same in this publication. In general twenty or more years of research work by biologically trained entomologists in the fields of ecological and biological control of insects will produce as great or more beneficial and practical results than a similar amount of time devoted to insecticides. Most insecticide entomologists will be unable to see or believe this statement. In all probability the author himself ten to fifteen years ago, when he was immersed in nicotine, paradichlorobenzene and other chemicals would have regarded such a statement as fallacious.

In some future publication the author may analyze and discuss this question; however, for the present he wishes to emphasize one important point of view which most economic entomologists fail to recognize or appreciate. In general, entomologists only see and think about those insects producing direct or indirect injury to man. If we examine the splendid book on destructive insects by Metcalf and Flint, we find listed 500 or more insect pests. How does this number compare with the 50,000 to 100,000 or more insects recorded for this country. For the sake of argument, say 1 per cent., or 1 out of 100. How many economic entomologists ever think of the 99 per cent. of the insects about us? It is highly probable that 50 per cent. or many more of all insect species are potential pests. What prevents the unimportant insects from becoming economic pests? Very few entomologists can answer this question for any unimportant insect. This brings up the important and startling situation:

What are we doing as economic entomologists? We are studying and worrying about the few species, 1 out of 100, which nature has failed to keep in check so far as man's interests are concerned. Briefly stated, we are devoting all our time to the insects which are successful in a man-made environment and by insecticides we are endeavoring to temporarily place these pests among the 99 out of the 100.

Let us compare our entomological business with that of the commercial world. Supposing a group of retail business men were endeavoring to ascertain the reasons for failures in certain lines, would they devote all their studies to those few concerns that had succeeded? Undoubtedly, they would investigate both the failures and successes in their field. Some day, perhaps in our generation, entomologists are going to see and study insects other than those confined to the 1 per cent. group. When that time comes we will be encouraged and paid to investigate with great care the numerous and unlimited examples of natural insect control about us on all sides. Undoubtedly careful studies will reveal facts, theories, and laws which man will eventually harness and employ to bring about a control of our major pests. To-day we are too busy worrying about the insects nature fails to control.

The author appreciates that the above thoughts may be idealistic, yet he feels that many of our economic entomologists are so steeped in oil emulsions, pyrethrum sprays, fluosilicates, etc., they fail to appreciate or sponsor the broader and more fundamental studies of the very insects they are trying to control and also the thousands of uncommon insects about them which hold for us answers to our problems.

Fortunately to-day the science of entomology shows signs of awakening to some of the possibilities in ecological and biological control due largely to the failure of insecticides in the control of a number of major insect pests. This change in the point of view of possible control is very encouraging and here is hoping this new awakening survives. It needs decided encouragement in this utilitarian age which demands immediate results.

In conclusion the author wishes to have it understood that he does not oppose the fundamental work with insecticides now in

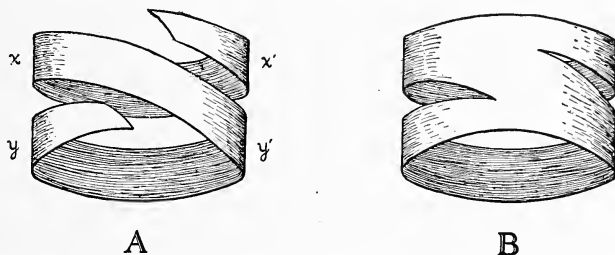
progress at some institutions. His only wish is that entomological executives in charge of insect projects in various institutions will sanction, encourage and boost long-time investigations in the fields of ecological and biological control. If ecological and biological control projects are given opportunities equal in all respects to insecticide studies now in progress, the author firmly believes the younger entomologists will live to see wonders accomplished in these fields.

AN OCCURRENCE OF SPIRAL SEGMENTATION IN APANTESIS NAIS (LEP., ARCT.)

BY E. T. LEARNED,
FALL RIVER, MASS.

Abnormal segmentation is one of the rarest forms of aberration to be found in insects and among such aberrations, which include fused, doubled, absent, split, incomplete and otherwise malformed somites, one of the most interesting is the condition known as spiral segmentation.

Spiral segmentation is due, apparently, to the fusion of opposite halves of adjacent segments with each other, to the exclusion of their proper halves; and since the faulty union occurs on only one aspect (either dorsal or ventral) and the somites have their normal relation on the opposite aspect, the result is a spiral formation of the involved segments. The condition is



shown diagrammatically in the text-figure A, which represents two segments fused on their upper surface (the left half of *x* being continuous with the right half of *y*) while on the lower surface they retain their normal relations.

The spiral may be complete, if the half segment which is left without a complement (either dorsally or ventrally) at the beginning and end of the spiral is completely separated from its proper half by a suture, as indicated in fig. A; or incomplete, when the halves remain more or less united, as in fig. B. The spiral may include two or more segments. In most of the cases reported in insects only two segments are involved, but occasionally three, and in one instance six segments are included. Once

established, the condition persists through all subsequent stages in the life of the insect.

Spiral segmentation was first described by Cori, and by Morgan, in papers which appeared at about the same time. Cori observed the condition in earthworms and polychaetes; in certain of the latter it is very common. It is not infrequent in earthworms along with other segmental anomalies, and Morgan's observations on these animals represent the only intensive study of spiral and other segmental anomalies which has been made. Two examples of spiral segmentation have been reported in Myriapods.

In insects spiral segmentation, or other segmental anomaly, is very rarely met with. Arendsen Hein in the course of experiments with the beetle *Tenebrio molitor* observed nearly 50,000 larvæ and among them found 104 which showed various segmental anomalies; some of these were of the spiral type. Abnormal segmentation, including the spiral, is also found in that very variable insect, *Drosophila*. Aside from its occurrence in these two species only seventeen examples of spiral segmentation in insects are described in the literature. Nearly half of these were reported not long ago by Dr. Cockayne; his paper also includes a brief summary of previously described examples, and presents the only critical discussion of the subject of anomalous segmentation in insects which has heretofore been published.

Four of the known instances of spiral segmentation in insects are in Lepidoptera. Christeller first described the condition in this order in a pupa (and its moth) of *Celerio euphorbiæ* in which the fourth to sixth abdominal segments form a spiral. The other three cases were described by Cockayne in the paper just referred to, in larvæ of *Pieris rapæ*, *Hipocrita jacobaeæ* and *Earias chlorana*. The latter is remarkable in having two separate spirals. In all these larvæ, the spirals involve two abdominal segments: the 2nd and 3d, and the 4th and 5th, respectively in *rapæ* and *jacobaeæ*: and the 3d and 4th, and 7th and 8th, in *chlorana*. The spirals are more or less incomplete in all.

The fact that only four instances of spiral segmentation have been recorded in Lepidoptera lends particular interest to the

case to be reported in which the condition occurred in six larvæ of one brood.

SPIRAL SEGMENTATION IN *APANTESIS NAIS*

In June of 1929 about forty eggs of *Apantesis nais* (Dru.) were received through the kindness of Mr. C. Rummel, from Green Village, N. J. The larvæ were normal, and the moths emerged in July. Three pairs of these moths were mated and their offspring were designated as broods nos. 114, 115 and 116. When these larvæ were about half grown certain individuals were conspicuous because of an irregularity of the dorsal line. This condition (which in all probability had been present at hatching but passed unnoticed while the larvæ were small) was at first attributed to injury, but on later examination proved to be due to spiral segmentation. The larvæ of all three broods, which numbered from 100 to 150 in each, were then carefully looked over and yielded a total of six abnormal larvæ in brood no. 116, while all the larvæ of the other broods were normal. All were reared under the same conditions.

The larvæ of *nais* hibernate and in the early fall the majority become lethargic and develop slowly, if at all. A small minority, however, will continue to feed actively and complete their metamorphosis without delay. Among eight such individuals of brood 116 were two of the abnormal larvæ, both of which gave female moths.

One of the abnormal females was mated with a male from one of the other broods; the larvæ from this pair were normal, as would be expected. Unfortunately, another generation could not be obtained as all larvæ which hibernated failed to survive the winter; while the moths obtained by forcing larvæ indoors could not be induced to mate, probably because of impaired vitality due to the unnatural conditions under which they were reared. The same difficulty has been frequently encountered in this and other species which have been forced through the winter.

The larvæ of *nais* are black, often (as in this lot) with a conspicuous yellowish dorsal line, or stripe; and with black warts bearing many setæ, of which wart i is very small, the rest quite large.

The conspicuous feature of the abnormal larvæ is the oblique displacement of the dorsal line over the involved segments, with a small offshoot at each angle running to the end of the incomplete suture.

The segmental abnormality is essentially the same in all six larvæ being of the spiral type with the involved segments incompletely separated and affecting either the 4th and 5th, or the 5th and 6th abdominal somites. The spiral is right handed in some, left handed in others. The defect in segmentation is evident only on the dorsum; the ventral surface appears normal.

All the warts are present, normal in size, with the usual setæ; spiracles are all present. With the exception of wart i, which is often crowded out of its normal relation to ii, all the warts are in practically normal relation to each other in each half-segment. Where there is marked outward displacement of a half-segment (*viz.*, right half of segment 4, left half of 5, in Fig. 2, Plate I) it is evident on lateral view by a lower position of the warts relative to those of the adjacent segments; this is due to the displacement of the half-segment as a unit, however, and not to any change in the normal relative positions of its warts. The larvæ were of normal size and vigor.

The appearance of the involved segments strongly suggests an effort on the part of the organism to form a single perfect segment by the oblique union of two half-segments at the expense of their proper halves. In Fig. 2 (Plate I), for instance, the left half of segment 5 and right half of segment 4 are crowded outward and narrowed, while left 4 and right 5 unite to form an oblique tergite of nearly normal width. Moreover, the warts of the half segments forming this oblique union tend to assume an arrangement which is normal relative to the abnormal segment as a whole. This is achieved to a remarkable extent in the larvæ shown in Fig. 2, in which the warts of the oblique segment have exactly the same relation to each other and to the obliquely displaced dorsal line as they would have on a normal segment.

The combined length of the two spiral segments on the dorsum is somewhat less than that of two normal ones, but the half-segments which are crowded out and narrowed above broaden to normal width below.

Each of the larvæ had the appearance of being slightly twisted on its longitudinal axis at the point of abnormality, the dorsal line and warts of the normal segments anterior to the spiral being distinctly out of line with those of the segments posterior to it. This appearance of torsion was much more marked in some larvæ than in others. It is evident in the segments shown in the drawings, and in the living larva seen as a whole was further emphasized by a little difference in the alignment of the spiracles and lateral warts of the anterior and posterior parts of the body. When some of these larvæ were crawling it appeared as if the posterior part did not "follow through" accurately, though the ventral surface of the larva was normal and there was no apparent displacement of the prolegs.

Figures 3 and 4 show the pupa-skins of the two moths which were reared. The caterpillars which formed these pupæ were essentially similar to the ones figured (except that in the insect shown in Fig. 3, the 5th and 6th segments were involved, instead of the 4th and 5th.) It is noticeable that while the abnormal segments are not completely separated in the larvæ, they have become distinctly separated in one of the pupæ (Fig. 3, in which the spiral effect is unusually clear) and nearly so in the other. Aside from the spiral segmentation the pupæ were normal.

The moths showed the same defect, and one of them was abnormal in coloration in that the markings of the fore-wings, normally yellow, were obsolescent on the distal half of the wing and dull brownish in color.

THE CAUSE AND ORIGIN OF ABNORMAL SEGMENTATION

The cause of segmental abnormality, of which spiral segmentation is one of the manifestations, is not known. While the evidence bearing on the occurrence of segmental anomalies is too scanty to warrant final conclusions as to their cause, it may nevertheless be interesting to review such facts and theories as are at hand.

It has often been supposed that abnormalities of segmentation were due to injuries received in the larval or pupal state. Possibly some defects are so caused, but such an injury as might conceivably produce so extensive a defect as spiral segmentation, for instance, would certainly result in the death of

the insect. There can be no doubt that most segmental anomalies, if not all, are developmental in origin.

Morgan found that in worms segmental anomalies often originated in the embryo. It might be expected that in insects also such abnormalities would be found to originate in the egg stage, and this supposition is confirmed by the finding of well established segmental defects in larvæ, and by the finding of embryos with such defects by Cappe de Baillon.

In explanation of the origin of segmental anomalies in worms, Morgan suggested that they were due to the unequal or irregular growth of the blocks of tissue which appear on each side of the mid-line in the embryo and represent primitive half-somites; that as a result of such irregular growth a half-somite would fail to unite evenly with its proper opposite half, but instead would overlap and unite with the half-somite adjacent thereto. If the overlapping occurred on only one aspect, a spiral would result. He made no statement as to what might be the cause of such irregular growth, apparently regarding it as due to some developmental peculiarity inherent in the individual.

A very similar theory was offered by Cori, who further suggested that the cause might lie in an unusually favorable environment during development, the abnormality resulting from unduly rapid growth.

Chapman, speaking particularly of spiral segmentation, thought the condition arose during the period of dorsal closure of the body cavity, and was due to the failure of the half-somites of one side to meet their corresponding opposites.

Spiral as well as other defects may be ventral, however, and Cockayne points out that Chapman's theory would not account for these; referring to instances where both dorsal and ventral defects occur in the same individual and assuming that all segmental defects are probably of similar origin, he argues that since ventral defects must originate very early in the process of segmentation in the embryo, then all segmental defects must arise in a "primary error" of segmentation.

Cappe de Baillon, in the course of his work on double monsters of the phasmid *Carausius morosus*, found segmental abnormality relatively frequent in embryos of such monsters, but regarded it as a purely secondary phenomenon resulting from pressure

within the egg caused by the unusually large embryo. "Selon toute vraisemblance," he says, "il s'agit ici d'une malformation banale qui n'a rien à voir avec la monstruosité double. Elle est simplement la conséquence du volume exagéré de l'embryon qui remplit déjà l'oeuf, alors que son abdomen est encore à peine formé." These segmental defects were not incompatible with life, the insects often reaching the adult stage.

The question of inheritance of segmental abnormality was studied by Arendsen Hein. In the course of experiments with *Tenebrio molitor*, previously mentioned, he bred the off-spring of abnormal beetles through several generations without increase in the incidence of abnormality over that in unselected stock, and concluded that segmental anomalies were not inherited.

In the fruit fly, however, inheritance evidently does take place. According to Morgan (who made the observations in the course of genetic studies without particular regard to the question of segmentation) individuals with irregularities of the rings of the abdomen are not uncommon in *Drosophila*, and he says, "sometimes they appear to have been caused by injury to the larvæ or pupæ, but still other abnormalities are inherited in the sense that they occur in certain stocks in more or less definite percentages."

One race in which extreme irregularity of segmentation occurred, described by Bridges and called "patched," came from a single female with reduced number (three) of segments.

The abnormal condition in flies of this sort was not influenced by environment, and the comparative frequency with which it appeared in inbred stock, and its rarity when the stock was out-crossed, was evidence of its inherent nature. Morgan was unable to secure a pure stock of such abnormals, however, the cultures invariably throwing a very high percentage of normals.

The occurrence of the six abnormal *nais* larvæ in one brood while sister broods were normal similarly suggests a genetic basis for the aberration.

Some comment may be offered on the facts presented in the foregoing review, without attempting to reach conclusions. As the evidence stands, the inference is that abnormal segmentation may result from different causes; on the one hand inherent and primary, on the other external and secondary; such a varied

origin would imply a corresponding variation in the extent of the structural involvement.

In regard to the question of primary developmental origin, it may be remarked that Morgan found that internal structures in earthworms corresponded with the external segmental defects, indicating a fundamental fault in the process of segmentation. While worms and insects are hardly comparable structurally, still it is reasonable to suppose that in the latter also such anomalies may be of similar origin, (or in other words are due to a "primary error" of development) and that the segmental involvement is similarly deep-seated in extent.

Such an early and fundamental error of development might well be expected to originate in a germinal abnormality inherent in the individual, and such an origin is clearly indicated by the inheritance of the condition in *Drosophila*; in such a case the cause must lie in some disturbance of the remote and inexplicable forces which govern the development of an organism.

On the other hand, the observations of Cappe de Baillon lead to an exactly opposite hypothesis. It is obvious that one must proceed with reservation in attempting to draw a parallel between anomalies occurring in the composite eggs of double monsters and those of normal insects. The basic conditions of development are the same in both, however, and justify consideration of Cappe de Baillon's observations,— which indicate that segmental anomaly may be an entirely secondary phenomenon in no way inherent but brought about by some extraneous cause.

From this point of view, abnormal segmentation might have its inception either early or late in the course of development, depending on what the cause might be and its time of action, and the extent and location of the structural involvement would vary accordingly. Chapman's theory of a fault in the dorsal closure may be recalled in this connection; a theory which receives support in the great preponderance of dorsal over ventral defects, particularly in the case of spirals.

Cockayne is inclined to believe that most segmental anomalies "taken at large are not inherent and must be due to some external cause acting upon the ovum at the very early stage when the somites are being formed."

His opinion, however, is largely based on the negative results of Arendsen Hein with regard to inheritance in *T. molitor*, and upon a condition of segmental anomaly in *Drosophila* showing sex-linked inheritance which will be considered later, and which should not be regarded as of the same type of anomaly of embryonic origin as that now under discussion. Cockayne refers to Cappe de Baillon's observations but, perhaps correctly, does not consider them applicable to examples of segmental anomaly in general.

Nevertheless, it may be tentatively remarked that possibly in the normal egg the embryo may rarely suffer some displacement or malposition which results in unequal pressure on developing segments. This would bring about some such unequal or irregular growth of the half somites as Morgan suggested, or at a later period interfere with normal dorsal closure. To speculate further on this line, it may be that the torsion of the body in the *nais* larvae and in other examples of spiral segmentation is not, as it obviously appears to be, a result of the deformity, but rather an indication of the cause of it, itself originating in some distortion of the embryo which secondarily resulted in the abnormal segmentation.

In such a case the inherited condition need not be an actual germinal defect, but some instability of the developmental processes which renders certain individuals more liable to developmental accidents, from whatever cause.

So far the consideration of segmental abnormality has been concerned with the appearance of the anomaly during the development of the embryo. Segmental abnormality may also make its appearance during post-embryonic development, however.

A race of *Drosophila* called "abnormal abdomen" and characterized by abnormal arrangement of the bands of the abdomen was reported by Morgan, which was entirely distinct from and not to be confused with those flies mentioned above in which the segmental abnormality appeared sporadically in various stocks. In the race now under consideration the abnormal character showed Mendelian inheritance, behaving as a sex-linked dominant, but appearing only under certain peculiar conditions of environment.

If these flies were reared in a wet culture the defect appeared; as the culture became dry, or if the parents were transferred to a dry bottle, the flies issuing thereafter appeared normal, but their descendants even after several normal generations would again show the abnormality if reared under the essential cultural conditions.

No observations on the larvae are recorded, but since it is stated that the influence of the wet condition did not appear unless the insects were subjected to it through part of the larval life, it must be inferred that the larvæ were normal. In this case the segmental abnormality must make its appearance in the course of the changes which take place during transformation from larva to adult.

A segmental anomaly which appears only in the adult cannot be the result of an error of segmentation in the embryo for in the latter case it would be bound to persist through all stages regardless of external conditions; neither is it probable that normal segmentation once established, and exhibited in the larva, could undergo any fundamental structural alteration in later life. As compared with those originating in a fault of embryonic development, these late appearing anomalies must therefore be comparatively superficial.

It is not improbable that in some anomalies (and this would apply particularly to the late appearing ones) the segmental involvement is essentially external, having its inception in defective development of the new hypoderm which replaces that of the larva during transformation to form the body-wall of the imago. The cause of the defective hypodermal development might ultimately lie in an inherent abnormality of the ectoderm (whether or not influenced by environment, as in *Drosophila*); or it might be due to the effect of external causes alone, as will be mentioned below.

According to this hypothesis anomalies of post-embryonic origin belong in a very different category from those arising in the egg. The only ground for a common origin of both the early and late appearing anomalies would be that the former are also essentially merely ectodermal in origin; and while it is perfectly possible that some of them are, it is more likely, as has already been observed from analogy with worms and for other reasons,

that anomalies of embryonic origin represent fundamental and deep-seated structural aberrations.

It is appropriate to mention here that evidence of ectodermal, or hypodermal abnormality, indicated by defective pigmentation and setae, is not infrequent in insects with segmental aberrations. Many segmental anomalies, too, have an obvious appearance of being due simply to incompleteness or malformation of the inter-segmental sutures, which suggests a superficial defect. Incidentally, defective pigmentation was particularly mentioned in the description of the "abnormal abdomen" race of *Drosophila*. Defects of pigmentation and setae would be expected in segmental anomaly due to ectodermal abnormality, or to defect of the hypodermal tissues from any other cause.

It is not intended to imply, however, that pigmental and setal defects are a criterion of the origin of the segmental anomalies with which they may be associated, for segmental abnormality due to a primary developmental error might be accompanied by ectodermal abnormality as a secondary condition. It may be noted in this regard that it was occasionally found in worms that the internal and external defects did not correspond, which led Morgan to conclude that at times the ectoderm may vary independently of the mesoderm.

Cockayne has remarked upon abnormality of ectodermal structures accompanying segmental anomaly, and one of his larvae with spiral segmentation (*E. chlorana*) shows extreme abnormality of setal and pigmental structure. On the other hand it will be recalled that in the *nais* larvae there was remarkable integrity of the ectodermal structures, which were in themselves quite normal though more or less displaced by the deformity. Evidently ectodermal abnormality is a secondary condition as regards spiral segmentation.

It is probable that the anomalies which arise in different stages of development are quite distinct in type. This conclusion is supported by the existence of two genotypes in *Drosophila*, in one of which the abnormality depends on a factor in the X-chromosome while in the other it is apparently due to multiple factors. If one may judge from Morgan's and Bridge's figures, too, the segmental defects in the "abnormal abdomen" mutant were much less extensive than in the "patched" variety. Among the

figures of the latter, incidentally, is one showing an excellent spiral.

There remain to be mentioned those abnormalities produced by certain physical agents.

Geigy reported that ultra-violet radiation of the eggs of *Drosophila* produced abnormalities in the adults among which were segmental anomalies (rings irregularly disposed, interrupted, or even missing), although the larvae which came directly from such eggs were of normal appearance.

A similar observation was made by Timofeef-Resovsky, who in the course of certain experiments with X-rays noted incidentally that eggs and larvae subjected to radiation often produced adults with abnormalities of segmentation.

The defects produced by these physical agencies are probably due simply to tissue injury. In the radiation of a very early egg stage the injurious effect may be exerted upon the ectoderm with consequent impairment of ectodermal structures in later life, while in more advanced stages direct injury may be done to the histoblasts from which the adult hypoderm is derived.

It may properly be questioned whether some of the abnormalities last considered are to be regarded as segmental anomalies at all, strictly speaking. Preliminary experiments with ultra-violet radiation (suggested by Geigy's paper) which I have made on *Drosophila* indicate that in some cases, at least, the anomalies so produced are entirely superficial without disturbance of segmentation, the appearance of irregularity being due solely to defective chitinization and pigmentation.

The foregoing review of the facts and theories bearing on the cause of abnormal segmentation is intended simply as a résumé of the information at present available in regard to these anomalies. Such comment as has been offered is necessarily largely speculative. Nothing whatever has been recorded on the internal anatomy of segmentally aberrant insects. Most of the observations are concerned with a single extremely variable insect, the fruit fly; and in this insect, with one exception, there is no definite knowledge of the presence or absence of anomalies in the early stages. Neither have segmental anomalies appearing under different conditions, and in different stages, been carefully compared with one another.

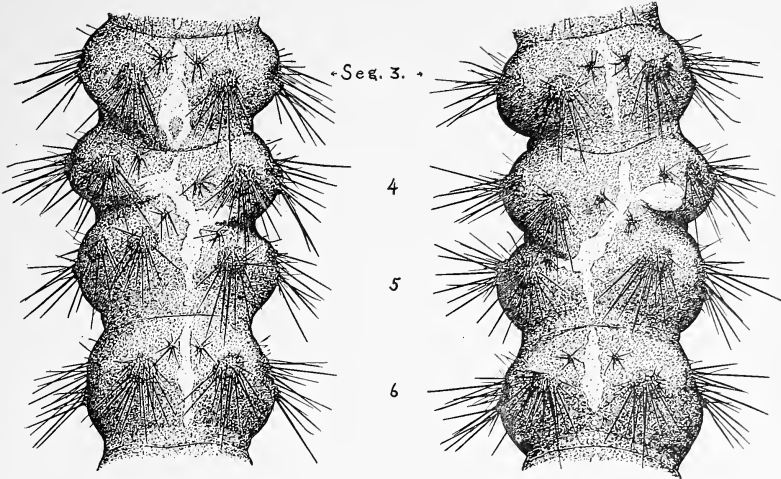
We can say only that abnormal segmentation is developmental in origin, and that apparently it may arise in the embryo either as a primary error of segmentation, the cause of which is inherent, or as a secondary result of some extraneous condition. In a different category are segmental anomalies which arise during transformation and appear only in the imago; the involvement in this type must be comparatively superficial as compared with anomalies of the embryonic origin. Still other abnormalities, related to the last type in their more superficial nature, may result from the injurious action of physical agencies. No definite conclusions in regard to the cause and origin of abnormal segmentation will be warranted, however, until much more has been learned about these interesting aberrations.

LITERATURE CITED

- ARENDSEN HEIN, S. A., Studies on variation in the meal worm, *Tenebrio molitor*, Jour. Genetics, vol. 10, pp. 227-231, 1920.
- BRIDGES, C. B., and MORGAN, T. H., The second-chromosome group of mutant characters, Publ. 278, Carnegie Inst. Wash., 1919; p. 241; pl. 11.
- CAPPE DE BAILLON, P., Recherches sur la teratologie des insectes, Eneye. Ent., Ser. A, p. 78, pp. 248-251, 1927.
- CHAPMAN, T. A., On insect teratology, Proc. So. Lond. Ent. & N. H. Soc. 1910-11, pp. 39-53.
- CHRISTELLER, E., Die missbildungen der schmetterlinge, Ent. Mitt., vol. 6, pp. 14-16, 1917.
- COCKAYNE, E. A., Spiral and other anomalous forms of segmentation, Trans. Ent. Soc. Lond., vol. 77, pp. 177-184, 1929.
- CERI, C. J., Über anomalien der segmentierung bei anneliden und deren bedeutung für die theorie der metamerie, Zs. wiss. Zool., vol. 54, pp. 569-578, 1892.
- GEIGY, R., Production d'anomalies par exposition de Drosophiles aux rayons ultra-violets, Verh. schweiz. naturf. Ges., vol. 108, pp. 191-192, 1927.
- MORGAN, T. H., Spiral modification of metamerism, Jour. Morphol., vol. 7, pp. 245-251, 1892.
- A study of metamerism, Quar. Jour. Micr. Sci., vol. 37, pp. 395-476, 1895.
- The rôle of the environment in the realization of a sex-linked Mendelian character in *Drosophila*, Am. Nat., vol. 49, pp. 385-429, 1915.
- TIMOFEEFF-RESSOVSKY, N. W., The effect of X-rays in producing somatic genovariations of a definite locus in different directions in *Drosophila melanogaster*, Am. Nat., vol. 63, p. 122, 1929.

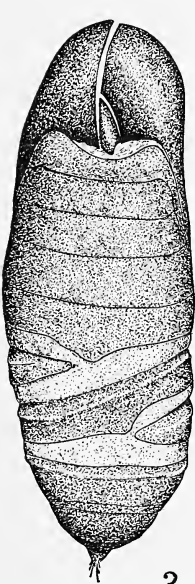
PLATE I

- Figure 1. Dorsal aspect of 3rd, 4th, 5th and 6th abdominal segments of a larva of *Apantesis nais* showing spiral segmentation.
- Figure 2. Another larva, with the spiral in the opposite direction; the same segments are involved.
- Figure 3. Pupal exuvia showing spiral segmentation. The larva which formed this pupa was similar to the one shown in Figure 1, except that the 5th and 6th segments were involved in the spiral instead of the 4th and 5th.
- Figure 4. Pupal exuvia. This pupa was formed by a larva similar to Figure 2.
- Figure 5. Abdomen of moth which emerged from the pupa shown in Figure 4.



1

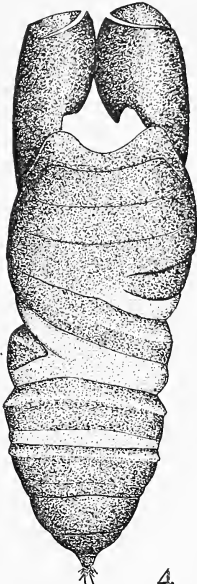
2



3



5



4

NEW NORTH AMERICAN SCARABAEIDAE, WITH
REMARKS ON KNOWN SPECIES

BY H. C. FALL

TYNGSBORO, MASS.

AEGIALIA

Aegialia convexa new species.

Ovate, rather ventricose and strongly convex; black, varying to dark brown, elytral suture narrowly rufescent.

The form is fairly intermediate between that of *conferta* and *crassa*. It agrees with *conferta* in the distinct and entire basal marginal line of the thorax, and the stout foliaceous metatibial spurs, but is nearer *crassa* in size, in its finer less impressed and less evidently punctate elytral striae, and in the stouter more triangular hind tibiae, the width of which at apex is nearly if not quite one-half the length of the posterior edge of the tibia. The head is similarly verrucose but a little less strongly so than in either *conferta* or *crassa*. The pronotal sculpture does not agree with either of these species, the surface being a little uneven, the punctures fine, sparse and distributed equally over the whole area of the disk except toward the side margins, the lateral fovea (as in *crassa*) indistinct or wanting.

Length 4.2 to 4.7 mm.; width 2.25 to 2.75 mm.

Type. Los Angeles Co., California, without more exact locality. Other examples, collected by the writer, were taken on or near the ocean beaches at Santa Monica and Redondo.

Inasmuch as practically all our blackish species of *Aegialia* vary individually in color to some shade of brown, there seems little use or point in dignifying so commonplace a variation with distinctive names. Of *Aegialia conferta* I have taken black, brown and intermediate individuals all at the same place in Southern California. To me varietal names here would be entirely superfluous, but to those who elect to use Mr. Brown's name *nigrella* for black specimens of *conferta* it may be pointed out that these and not the brown examples constitute the typical form of the species, as is unequivocally stated in Horn's original description.

APHODIUS

The last systematic treatment of the genus *Aphodius* within our faunal limits—that of Horn in 1887—recognized 81 species.

Since that time very many new forms have been described, so that the total number at present cannot fall far short of 140, and there are yet more to come. The situation for the student who desires to identify his specimens is already so bad that it cannot be made much worse by the descriptions of six additional species in the following pages. An effort has been made to correlate these with previously known species so that they may be readily incorporated in new tables which it is to be hoped some one may soon prepare or bring together for the whole genus. A few notes on known species are first presented.

Aphodius longitarsis Fall.

The specific name being preoccupied was changed by Reitter to *tenuitarsis* (Wien Ent. Zeit., 1908, p. 36), which reference seems to have been generally overlooked and the species appears in the Leng Supplement under the name *peculiosus*, proposed by Schmidt in 1922. The name substituted by Reitter proves also to have been preoccupied by Fairmaire for a Madagascan species, so that Schmidt's name *peculiosus* prevails for our species.

Aphodius (Didactylia) parvus Horn.

This little species is known to me from three Florida specimens only, two including the type in the Horn collection, and the third bearing name label in Horn's hand in the Le Conte cabinet. There occurs along the New Jersey and Georgia sea coast an extremely similar form which passes as *parvus* in collections but which is not strictly conspecific therewith, and in one important respect is more nearly in accord with *knausi*, of which I at present consider it a local variant. In *knausi* the fimbriation of the lateral edge of the thorax consists of only three or four rather long setae anteriorly, the posterior half being quite destitute of marginal hairs. In *parvus* the marginal setae are shorter, about eight or nine in number and extend almost throughout the length. In *knausi* the pronotum is always clouded with a darker tint and the elytra always show some maculation, of which a small transverse spot across the suture at about the middle is characteristic. In *parvus* the size is a little smaller and the upper surface is immaculate, there being at most only a faint median shade on the pronotum. In the sea shore form alluded to above the markings

vary from fairly distinct to nearly or quite lacking, but the pronotal fimbriation is in every one of the dozen examples studied substantially as in *knausi*, and not at all as in *parvus*. The difference in sinuation of the sides of the basal margin of the pronotum suggested by Mr. Brown (Can. Ent., 1929, p. 91) for distinguishing *parvus* and *knausi* is not a satisfactory criterion in my experience.

Aphodius inutilis Horn.

A specimen in my collection from Chinchilla, Pa., sent me by Mr. Champlain, was found to run to *inutilis* by Horn's tables. Doubting the accuracy of the reference because of the published locality of *inutilis* (California, Oregon) I sent the specimen to Mr. Liebeck, who compared it with Horn's type and found it to be the same. Mr. Liebeck also discovered a like specimen from Boonton, New Jersey, in his own collection. The species is a rare or little known one and I know of no instance of its recognition from anywhere between these widely separated regions.

Aphodius testaceiventris new species.

Belongs to Horn's Group A, and is closely allied to *denticulatus*.

Body oblong oval, moderately elongate, black, clypeus rufescent, abdomen dull testaceous, legs dark rufous or rufopiceous; surface moderately shining, the elytra somewhat less so because of an evident alutaceous ground sculpture.

Head moderately punctate, more sparsely at middle of front, base smooth; frontal suture distinctly cariniform and feebly trituberculate; clypeus with a short transverse elevation at middle, margin obtusely biangulate each side of the median sinus.

Prothorax two-fifths wider than long, sides broadly arcuate and not very strongly convergent to the front, hind angles obtuse but well defined; surface with somewhat unevenly distributed coarser and finer punctures intermixed.

Elytra slightly wider than the thorax, scarcely widened behind; striae finely punctured, intervals a little convex, each with a fairly regular row of punctures each side. Body beneath with very few fine punctures; middle and hind thighs with a longitudinal row of setigerous punctures in outer half or more.

Length 5.4 to 5.6 mm.; width 2.5 to 2.85 mm.

Hamilton Co., Kansas (F. H. Snow). Three examples received many years ago from Prof. Snow, probably as *denticulatus*.

As stated above this species is nearly related to *denticulatus*. The size is a little smaller than in the latter, the clypeal angulations less prominent, pronotum relatively more coarsely punctate, the hind angles well defined (broadly rounded in *denticulatus*). The margins of the body are ciliate, but less densely so than in *denticulatus*, and the hind tibiae are not closely fimbriate within, there being merely a few widely spaced short hairs along the inner margin.

I am uncertain as to the sexes. One of the three examples is more robust than the other two, the protibial spur shorter, the spurs of the middle tibiae not very unequal, while in the other two examples the longer spur is nearly twice the length of the shorter; these may be assumed to be males, and one of them is taken as the type.

Aphodius incommunis new species.

Oblong, moderately elongate, nearly parallel sided, integuments strongly shining. Head rufous, front and clypeus densely rugose punctate, occiput closely punctate, frontal suture feebly trituberculate, clypeus with median transverse carina, margin sharply bidentate.

Prothorax transversely subquadrate, black, apical margin narrowly, lateral margin more broadly rufous; one-third wider than long, sides subparallel, a little convergent in front, hind angles obtusely rounded as viewed from the side; surface with rather sparse larger and smaller punctures intermixed; side margins closely fimbriate.

Elytra at base subequal in width to the thorax, just perceptibly widening posteriorly, two-fifths longer than wide; color reddish yellow varied with darker brown, the latter forming on each elytron a somewhat indefinite antero-median discal area which encloses a pale streak on the fifth interval and sends a spur forward to the base of this same interval; there is also a vague subapical fascia behind a paler fascia at the summit of the declivity. Striae moderately finely punctate, intervals almost impunctate, polished.

Body beneath reddish brown, sparsely punctate, with yellow hairs. Protibiae crenulate above, terminal spur slender, curved and gradually pointed, not quite attaining the apex of the second tarsal joint; spurs of middle tibiae slender, the lower spur but little more than half the length of the upper; middle and hind thighs smooth with a few scattered very fine punctures; basal joint of hind tarsus as long as the three following.

Length 4.8 mm.; width 2.2 mm.

The unique type (sex unknown) was taken at Vernon, British Columbia, V-2-24, by Mr. Hopping, from whom I received it.

The characters of the above species attach it to Horn's Group B, where it must be associated with the species at the beginning of the table. It differs from all of these by the color and distinctly bidentate clypeus.

Aphodius fortunus new species.

Elongate oblong, rufocastaneous throughout, integuments polished.

Head densely punctate, frontal suture not distinctly tuberculate; clypeus with an obtuse median transverse tumidity; margin bidentate, the teeth short, distinctly reflexed and with a small exteriorly adjacent sinus; genæ prominent, subrectangular but with the angle rounded.

Prothorax three-fifths wider than long, sides nearly straight and slightly convergent toward the front; hind angles obtuse, fairly well defined; punctation intermixed, the coarser punctures sparse on the disk but more numerous laterally; median line narrowly smooth posteriorly, a shallow foveiform impression at sides anteriorly and another more oblique near the hind angles; margin not distinctly fimbriate:

Elytra at base as wide as the thorax, sides parallel and very broadly arcuate; striæ rather finely closely punctate; intervals nearly flat with sparse minute punctures.

Body beneath with sparse punctures and pale hairs. Protibiæ scarcely crenulate above, terminal spur long and slender; upper spur of middle tibiæ about twice as long as the lower; middle and hind femora with a few very fine punctures and a row of coarser setigerous punctures externally; basal joint of hind tarsus a little shorter than the next three.

Length 5 mm.; width 2.25 mm.

Arizona (White Mts., Gila Co.). A single specimen, probably a male, received from Mr. Poling. It bears date Aug. 15-30, 1925.

This species runs to Horn's Group B, and in clypeal formation is most nearly related to the preceding species. The only other entirely red species of this group is *arizonensis* Schaef., which has the clypeal margin sinuate with broadly rounded angles.

The following table presents the diagnostic characters of the small group containing this and the preceding species.

Clypeus with a prominent tooth on either side of the emargination.

Color reddish, pronotum blackish except front and side margins, elytra variegated with darker brown. (British Columbia).....*incommunis*.

Color uniformly dark red throughout, clypeal tooth shorter, thorax more strongly transverse. (Arizona).....*fortunus*.

Clypeus usually more or less distinctly biangulate, the angles however becoming more prominent or subdentiform in some individuals.

Small species (3.8 to 5 mm.), color entirely black.

Form short, robust, broader behind as in certain *Aegialia*. (Florida).

crassulus.

Form less stout, not at all widened posteriorly.

Elytra shorter and more convex in profile; prothorax at sides more densely punctate; genæ prominent (Tex. and La.).....*abusus*.

Elytra longer and less convex, prothorax more sparsely punctate laterally, genæ more broadly rounded and less prominent. (New Mexico; Arizona)*crassuloides*.

Larger species (6.5 to 7 mm.); black, elytra clear red. (Colorado).

bidentatus Schmidt (*bidens* || Lec.)

In the Supplement to the Leng Check List *abusus* and *crassuloides* are interrogatively referred to *crassulus* Horn on the authority of A. Schmidt.

I do not know upon what basis of material this author founds his surmise, but I feel quite sure he is incorrect and doubt very much if he has ever seen an example of the true *crassulus*, which is thus far a very scarce species and known only from Florida.

***Aphodius claudus* new species.**

Closely similar to *concavus* Say and possibly only a small race of that species. Four differential characters are fairly distinct throughout my series, and while no single one of them carries much weight, the four in combination appear to warrant a tentative separation.

In the present species the size is materially smaller, the length varying from 5.5 to 7 mm. Horn gives for *concavus* 8 to 8.5 mm., which covers the material in my own series. The hind angles of the prothorax are more rounded than in *concavus*, in which they are somewhat defined though obtuse with rounded vertices. The very fine punctures of the pronotum and elytral intervals are noticeably less minute than in *concavus*, and the elytral intervals show under considerable amplification an extremely fine alutaceous sculpture not discoverable on the highly polished integuments of *concavus*. In color, form of body, clypeal outline, type of punctuation, body beneath and legs, including tibial spurs, the present species is closely in accord with *concavus*.

Described from a series of six specimens (2 ♂, 4 ♀) collected by Mr. O. C. Poling at Alpine, Texas. The type is a male and bears date May 1-15, 1926.

In *concavus* the clypeal margin is said to be rounded each side of the emargination. This is the typical form, but in some individuals there is an evident though very obtuse angulation limiting the median sinus. This feeble angulation is similarly

perceptible in *claudus*, and the table should be modified to include this variation.

Aphodius crenicollis new species.

Oblong, moderately convex, entirely dark red brown, shining.

Head rather densely punctate, rugulose anteriorly, frontal suture very fine, obsolete at middle, its lateral tubercles faintly visible. Clypeal margin broadly truncato-emarginate at middle with a small prominent triangular denticle each side; genæ prominent, subrectangular; margins fimbriate.

Prothorax one-half wider than long, trapezoidal, the sides feebly convergent and almost straight throughout; base strongly arcuate, marginal line entire, hind angles obtuse, rounded; side margins fimbriate and crenulate; disk loosely not coarsely punctate at middle, becoming more coarsely and quite densely so laterally; minute interstitial punctures lacking, sides with rather large anterior and posterior concavities which cause the margin to appear subexplanate, especially at the hind angles.

Elytra parallel, two and two-fifths times as long as the thorax, striae fine and very finely punctate, intervals nearly flat, smooth and polished, punctures numerous and distinctly coarser than those of the striae.

Body beneath sparsely finely punctate; protibiae strongly tridentate, not perceptibly crenulate above; basal joint of hind tarsus barely as long as the next two.

Length 5.7 mm.; width 2.6 mm.

Modoc Co., California. A single example collected and sent me by Mr. Nunenmacher. It bears date V-15-13.

This species is a member of Horn's Group Ia and is most nearly allied to *militaris*. As in *militaris* the punctures of the elytral intervals are coarser than those of the striae, but they are evidently less so than in the latter species. The hind angles of the thorax are less broadly rounded than in *militaris* but less well defined than in *æmulus*. Neither of these two species has the lateral thoracic margin crenulate.

Aphodius ruficlarus new species.

Oblong oval, strangely convex, clear pale red throughout, integuments polished.

Head very finely evenly sparsely punctate; frontal suture very fine, lateral transverse tubercles barely detectable, median one lacking; clypeus arcuately emarginate, the emargination limited each side by a small sharply defined triangular denticle which forms the termination of a short but distinct longitudinal carina; genæ broadly obtusely rounded, feebly prominent.

Prothorax moderately transverse, sides very broadly arcuate and slightly convergent from the rounded base angles; basal marginal line interrupted for a short distance each side, lateral margins sparsely fimbriate; disk finely

sparsely punctate, the punctures gradually closer and coarser laterally, the interstices throughout with more minute scattered punctures.

Elytra finely but rather deeply striate, stria punctures fine; inter-spaces a little convex, sparsely minutely punctulate.

Body beneath sparsely finely punctate and thinly pubescent; protibiae strongly acutely tridentate, above finely crenulate; basal joint of hind tarsus a little shorter than the next three.

Length 6.4 mm.; width 3 mm.

Phoenix, Arizona.

Described from a single example, sex unknown but probably a female, all the tibial spurs being slender and acute. The larger size, very finely punctate head, and undefined angles of the thorax will serve definitely to distinguish this species from *æmulus* Horn, to which it is most nearly allied. In all specimens of *æmulus* seen by me the basal marginal line of the thorax is entire.

PSAMMOBIUS

Psammobius armaticeps new species.

Oblong, slightly widened posteriorly. Type: dark brown above, thorax and occiput piceous, beneath reddish brown, integuments shining.

Head verrucose, clypeus broadly emarginate, the limiting angles dentiform and somewhat reflexed, genæ moderately prominent.

Prothorax three-eighths wider than long, scarcely narrowed in front, sides evenly arcuate, margins feebly crenulate and sparsely fimbriate; disk coarsely numerous unevenly punctate, without trace of either transverse or longitudinal grooves, sides rather widely smooth, a transverse impression within the front angles; base with entire marginal line, hind angles very obtuse, scarcely defined, front angles rounded.

Elytra one-third longer than wide, as wide at base as the thorax, very slightly broader behind; striae strongly impressed, punctate, intervals a little convex, almost perfectly smooth.

Mesosternum finely carinate between the coxæ; ventral segments each with a single transverse row of coarse punctures interrupted at middle. Hind femora very stout, with a row of closely placed rather coarse setiferous punctures parallel with the hind margin; hind tibiae stout, subtriangular, without trace of transverse ridge, the terminal spurs a little expanded before the apex, the longer subequal in length to the first two tarsal joints, which are typically triangular.

Length 3.35 to 3.7 mm.; width 1.65 to 1.8 mm.

The type and one other specimen were taken by the writer at Pensacola, Florida, July 8, 1893. A third example, from Tybee Island, Georgia, is entirely ferruginous in color and has the

pronotal punctures grouped in a transverse arcuate band behind the middle, leaving the anterior part of the disk nearly smooth except for some irregular wrinkles: in all other respects it agrees well with the Pensacola types.

Because of its bidentate clypeus this species was for a time assumed by me to be the *bidens* of Horn. A true exponent of the latter taken more recently at Dunedin, Florida, shows the two forms to be quite distinct. In *bidens* the pronotum is much more sparsely punctate, the hind femora smooth without the row of setigerous punctures, hind tibiae not triangular and with a transverse ridge, the spurs of the hind tibiae slender, not at all foliaceous, the ventral segments irregularly punctate.

***Psammobius blandus* new species.**

Oblong, a little wider behind; flavotestaceous, shining.

Head coarsely verrucose, occiput somewhat vaguely transversely impressed; clypeus rather deeply emarginate, the limiting angles well defined, slightly obtuse.

Prothorax fully one-third wider than long, sides strongly arcuate, front angles well defined and acute as viewed from above; hind angles undefined, the sides broadly rounding into the base; margins not crenulate, except finely so near the front angles. Surface shining throughout, a well marked and entire anterior marginal groove and three discal grooves, all interrupted at middle by a longitudinal sulcus which is abbreviated in front. The transverse grooves are vaguely punctate but the intervening ridges and a broad lateral convexity are quite smooth; basal marginal line fine.

Elytra moderately strongly convex, suboval, slightly more than one-fourth longer than wide, at base scarcely as wide as the thorax but distinctly wider than the latter posteriorly, humeri not dentate. Striae moderately deep, closely and rather strongly punctate; intervals perceptibly convex, sparsely almost invisibly punctulate, the outer ones minutely alutaceous but shining.

Mesosternum not carinate; metasternum smooth; ventral sutures very fine, the segments smooth and apparently impunctate, but a few irregularly dispersed minute punctules are discoverable on close inspection. Middle and hind femora stout, smooth and shining, a row of three or four fine setigerous punctures in outer half. Hind tibiae rather stout, without transverse ridges but with usual rows of tubercles, apex one-half as wide as the length of hind margin; spurs not very stout but perceptibly wider at apical third, apex moderately acute; posterior tarsi lacking.

Length 2.8 mm.; width 1.35 mm.

El Paso, Texas. A single example taken by the writer Nov. 17, 1889.

It is not possible to say whether the pale color is normal or due to immaturity, but there is no other indication of the latter. The very fine ventral sutures and virtually impunctate ventral segments with the few discoverable punctules irregularly dispersed instead of arranged in transverse rows, constitute the peculiar features of this species. In general aspect it most resembles *5-plicatus*.

Psammobius mimeticus new species.

Very closely similar to *interruptus* in size, form, color and sculpture, but the elytral intervals instead of being nearly flat as in that species are all distinctly convex or obtusely cariniform. The pronotum is a little duller with more numerous granuliform elevations than in the few specimens of *interruptus* seen, but this distinction is likely to prove evanescent.

Described from three examples given me many years ago by Chas. Fuchs, and all collected at San José del Cabo, in the Cape region of Lower California.

DIPLLOTAXIS

Diplotaxis mus new species.

Oblong oval, twice as long as wide; brown with faint greenish bronze reflections, sparsely clothed with short appressed squamiform hairs which are more abundant and more scale-like beneath.

Labrum deeply arcuately emarginate; mentum flatly convex, declivous only at its apex and completely devoid of transverse ridge and erect setæ. Head large, three-fourths as wide as the prothorax; clypeal margin moderately reflexed, broadly arcuate throughout; clypeal suture feebly defined, not impressed; front flat, head throughout closely coarsely punctate; eyes separated by about five times their own width.

Prothorax strongly transverse, not quite twice as wide as long, sides broadly arcuate, base but little wider than the apex; surface coarsely closely punctate, more densely so laterally, a small smooth spot at middle of disk; median lateral fovea weak.

Elytra two-fifths longer than wide and three times as long as the thorax, feebly dilated behind; costæ faint; strial and intercostal punctures coarse and close set, the latter confused on all the intercostal spaces.

Upper tooth of protibia slightly nearer the apex than the base of the tibia; ungual tooth at about the apical third of the claw.

Length 5.5 mm.; width 2.7 mm.

Described from a single example, sex unknown, bearing label Cochise Co., Arizona, VI-9-08.

This little species is not at all like any of the previously described pubescent species, differing sharply from them all in

its appressed subsquamiform vestiture. It may best be placed for the present at the end of the pubescent group, following *sparsesetosa*.

***Diplotaxis protensa* new species.**

Elongate oblong, parallel, red brown to black, shining, alutaceous sculpture not perceptible except under high power.

Mentum of the type indicated under caption "12" in my table, the anterior declivity beginning at about the basal third, the summit of the declivity without raised line and without setae, at least at middle. Front and clypeus in some plane, margin of the latter broadly sinuate with rounded angles; postclypeal convexity obsolete or but very feebly indicated, punctuation moderately coarse, dense, a little sparser at middle of vertex.

Prothorax about six-sevenths wider than long, sides broadly arcuate, convergent in front, subparallel basally without sinuation. Surface rather finely not closely punctate, with feeble median and posterior sublateral impressions.

Elytra typically rather more than two-fifths longer than wide and slightly less than three and one-half times as long as the thorax. Discal costae scarcely convex, intercostae all broadly confusedly punctate.

Body beneath moderately punctate at sides, very finely and sparsely so at middle. Upper tooth of protibia distinctly nearer the apical tooth than to the base of the tibia; hind thighs subimpunctate between the submarginal rows of punctures; apex of claw tooth about twice as distant from the base of the claw as from the tip.

Described from a good series of specimens from Mescalera Res., New Mexico, and Bent, New Mexico, all submitted by Mr. K. F. Chamberlain, of the New York State Museum at Albany. The type is a reddish brown example from the first named locality and bears date VII-1927.

This species by its narrow parallel form most closely resembles *parallelus*. By the tabular characters however it runs to vicinity of *belfragei*, differing therefrom by its narrower form, longer mental declivity and more strongly postmedian ungual tooth.

***Diplotaxis villosipes* new species.**

Robust, oblong, subparallel, black, shining, not perceptibly alutaceous.

Mentum horizontal and flatly concave behind the anterior declivity, which is not steep and is margined at summit with a setiferous raised line. Antennal club subequal in length to the funicle; last joint of maxillary palpi broadly ovate pointed and bearing a deep oval impression which occupies rather more than the middle two fourths of the length.

Head two-thirds as wide as the thorax; clypeal margin lightly sinuate at middle, suture moderate, front without postclypeal convexity; punctuation fairly dense, a little less close on the clypeus.

Prothorax one-half wider than long, sides subangularly rounded at middle, thence strongly narrowed to front and rear, evidently sinuate anteriorly, barely visibly so posteriorly; base not quite one-third wider than apex, all the angles sharply defined with nearly rectangular apices; surface rather sparsely not coarsely punctate, punctures separated by one or two times their own diameters, a slight impression at middle near the side and another between this and the front angle.

Elytra two-fifths longer than wide, and one-fifth wider than the thorax, sides parallel and broadly arcuate; costæ undefined; punctures of the first broad interspace confused throughout, in the second only slightly so, and in the third confused toward the base but forming a single line behind the middle.

Pygidium closely subrugosely punctate. Body beneath moderately punctate; metasternum strongly concave at middle; ventral segments each with a transverse more densely punctate median area bearing erect hairs. Upper tooth of protibia equidistant from base and apex; tip of unguis on front and hind feet about two-thirds as far from the apex as from the base of the claw; on the middle feet the claw tooth is very small and rudimentary. All the femora and tibiae are very densely clothed with fine erect hair on the inner or lower side, that of the hind tibia being longest. The front tarsi are more sparsely hairy within, while the four posterior tarsi entirely lack the fringe of hairs.

Length 13.5 mm.; width 7 mm.

Described from a single male specimen taken at Holtville, Imperial Co., California, IV-3-24, and sent me by Mr. A. C. Davis.

This remarkably fine species is obviously nearly allied to *illustris*, but differs therefrom in many details. *Illustris* is a somewhat smaller species, elytral costæ fairly well defined, intercostal intervals all confusedly punctate, last joint of maxillary palpi much narrower, the front and hind legs only densely hairy within, the unguis more posterior in position and that of the middle claw of normal length; the hind tibiae have a row of five or six stiff spines along the posterior half of lower edge (not mentioned in original description), there being no trace of these in the present species.

***Diploptaxis futilis* new species.**

Oblong ovate, dark chestnut brown, elytra minutely reticulate, thorax not perceptibly so.

Mentum flat behind, declivous anteriorly with well developed transverse ridge and row of erect setae. Clypeus broadly emarginate, rather narrowly reflexed, suture distinctly impressed, no postclypeal convexity; front flatly convex, punctures separated by from one-half to fully their own diameters.

Prothorax two-thirds wider than long, sides narrowly margined, rounded at middle, convergent in front, nearly straight and parallel posteriorly; base two-fifths wider than apex; surface rather sparsely punctate, the punctures distant from one to two times their diameters throughout; median lateral fovea evident, a short vague transverse impression before each hind angle.

Elytra one-fourth longer than wide and two and three-fourths times as long as the prothorax, widest behind the middle; costæ feeble, intercostal spaces wide and all with confused punctuation.

Upper tooth of protibia perceptibly nearer the apex than the base of the tibia; ungual tooth subapical and subequal in length to the upper part of the claw, which in consequence appears to be cleft with the inner part a little thicker.

Length 8 mm.; width 4.5 mm.

Described from a single example from Nogales, Arizona, VIII-31-06, collected and submitted by Mr. Nunenmacher.

An ordinary looking species with no special structural features, which by the tabular characters runs to *marginicollis*. From the latter it differs by its less parallel form, and more especially by its more finely margined thorax which is more narrowed in front.

All of the three following species are of the type of *chiricahuæ*, to which they are similar in form, size, rufotestaceous color, ungual formation and most other characters except as noted in the following short comparative diagnoses.

***Diplotaxis producta* new species.**

Clypeal margin strongly advanced, moderately reflexed, arcuately emarginate between the prominent limiting angles, the outer sides of which are nearly or quite parallel with the axis of the body. Anterior margin of pronotum not or scarcely visibly more prominent at middle (quite perceptibly so in *chiricahuæ*). Hind angles of prothorax rounded, their vertices not defined as viewed from the side (very obtuse but clearly defined in *chiricahuæ*). All the elytral intercostæ with confused punctuation.

Length 5.3 to 7.3 mm.; width 3 to 3.5 mm.

Described from a series of fifteen specimens, the greater number, including the type, taken at Alpine, Texas, May and June, 1925, by O. C. Poling. Other examples bear labels Cherry Canyon, Fort Davis, Davis Mts., Texas (sent by Mr. A. W. Andrews of Detroit), and Fort Davis and Brewster Co., Texas (sent by Mr. K. F. Chamberlain from the Albany, N. Y., State Museum, these probably also collected by Poling).

***Diplotaxis pinalica* new species.**

Closely allied to *chiricahuæ* but a little larger and stouter, more widened behind and more punctate than the latter. Clypeus trapezoidal, emarginate between the well defined but obtuse angles which are not or only just perceptibly sinuate on their oblique outer sides. Hind angles of prothorax only barely defined in lateral view; disk of pronotum with distinct median smooth line behind the middle (not present in any of the allied species). Elytral intercostæ all with much confused punctuation.

Length 7.5 to 8 mm.; width 3.8 to 4.1 mm.

Described from four perfectly similar examples collected by Poling in the Pinal Mountains of Arizona, elevation around 5000 ft., April, 1925.

***Diplotaxis deserta* new species.**

Smaller than *chiricahuæ* or the two preceding species. Clypeus trapezoidal, feebly emarginate, limiting angles obtuse, less sharply defined, not sinuate externally. Front margin of pronotum slightly more prominent medially; hind angles of thorax rounded and not defined in lateral view. First intercostal space of elytra confusedly punctate, second with a single row of punctures, third with punctures confused only toward the base.

Length 5.5 to 6.2 mm.; width 2.9 to 3.15 mm.

California: Palm Springs, VII-23-27 (♂ ♀); Stoddard Well, Mojave Desert, 1 ♀; all submitted by Mr. A. C. Davis. The Palm Springs male is selected as the type.

***Diplotaxis incuria* new species.**

Size small, oblong oval (moderately oval), moderately elongate, a little wider behind; piceous brown, thorax a little paler and more reddish in some examples.

Transverse mental ridge with accompanying setæ well defined. Clypeus trapezoidal, margin feebly emarginate to nearly truncate, angles obtuse but distinct, not or scarcely sinuate externally. Head including clypeus densely rather coarsely punctate; front rather strongly convex but without definite postclypeal ridge. Eyes small and feebly convex, very narrow as viewed from the front, their width about one-ninth their distance apart.

Prothorax fully two-thirds wider than long, base slightly wider than apex, widest a little behind the middle where the sides are strongly subangularly rounded, feebly sinuate in front and just perceptibly so before the hind angles which however are rounded and undefined. Surface shining, not perceptibly alutaceous, coarsely punctate, the punctures distant by about their own widths at middle, closer at sides; median lateral fovea evident.

Elytra two and three-fourths times as long as the thorax and about one-third longer than wide; surface finely alutaceous and dully shining; first intercostal space with confused punctures, second and third with punctures usually more or less confused but in one example scarcely at all so.

Body beneath coarsely punctate; upper tooth of protibia at about the middle of the length of the latter; ungual tooth strongly postmedian, its tip rather more than twice as remote from the base as from the apex of the claw.

Length 5.6 to 6.2 mm.; width 2.75 to 3 mm.

Nevada (Esmeralda Co.) Four examples collected by Mr. Nunenmacher and bearing dates VI-28-07 and VI-16-08; the type bears the first named date.

This little species most nearly resembles *misella* in form, size and its coarse punctuation, but is much darker in color. By the tabular characters it runs to "42" of my table where it is best placed between *punctata* and *chiricahuæ*. From *truncatula* and *punctata* it differs by its smaller size, much less robust form, and more narrowly rounded sides of prothorax, and from both these and *chiricahuæ* by its most distinctive peculiarity the smaller less prominent eyes, which in the two first named species are separated by one-fourth to one-fifth, and in *chiricahuæ* by two-fifths to one-third the ocular width, the variations within specific limits being probably mainly sexual. I am unable to definitely distinguish the sexes in the four samples of the present species but in one of them the eyes are just perceptibly more developed and the elytra are more nearly parallel sided, which probably indicates a male.

PHYLLOPHAGA

Phyllophaga contaminata new species.

Elongate, moderately convex, a little broader behind; blackish brown, shining, upper surface glabrous.

Head coarsely closely punctate, the clypeus more sparsely so, the latter with strongly reflexed margin which is truncate with rounded angles; clypeal suture lightly impressed. Antennæ 9-jointed, club (♂) about one-fourth longer than the stem.

Prothorax two-fifths wider than long; sides rather narrowly rounded and widest at basal two-fifths, thence straight, strongly convergent, ciliate and feebly crenulate in front; less convergent, nearly straight and without ciliae or crenulation posteriorly; hind angles obtuse but well defined; surface polished, sparsely, somewhat unevenly and not coarsely punctate, apical margin thickened.

Elytra moderately finely and closely punctate, the punctures distinctly separated laterally, becoming more or less rugulose confluent toward the suture; sutural striae deep, the sutural costa conspicuous, discal costae wanting.

Pygidium alutaceous, very sparsely punctured. Metasternum with rather long pale hairs; abdomen more sparsely punctate with shorter hairs. Pro-tibiae bidentate; four anterior femora rather slender, hind femur nearly twice as broad; claws with a small acute tooth close to the base.

Length 10.5 mm.; width 4.8 mm.

The unique male type bears label "San Bartolome, Dist. Sur, Baja Calif., July 15, 1919; G. F. Ferris."

As indicated the type is certainly a male, but there are no obvious ventral sexual characters. The spurs of the hind tibiae are rather slender, slightly unequal but otherwise similar, and both are free.

This species clearly possesses the characteristics of Horn's Group XVIII, though it was first placed in my cabinet as an aberrant *Listrochelus*. It is at once separable from the few species of the group by its nearly black color.

***Phyllophaga extranea* new species.**

Oblong oval, wider behind; yellowish testaceous, clypeus rufous with darker margins, prothorax with two small subapical diffuse brownish spots; upper surface glabrous, moderately shining.

Head sparsely punctate, clypeus remotely so, the latter broadly arcuately emarginate between the obtuse but well defined angles; clypeal suture very fine, not impressed. Antennae (♂) 9-jointed, club almost one-half longer than the stem.

Prothorax three-fifths wider than long, widest just behind the middle, apex narrower than base, sides anteriorly nearly straight and strongly convergent, less convergent behind and rounding into the base; margin sparsely fimbriate with long erect hairs except near the base, but not perceptibly crenulate as viewed from above; anterior margin narrowly thickened; surface shining with fine sparse somewhat unevenly dispersed punctures.

Elytra rather finely and closely punctate; sutural costa well defined, discal costae lacking; margin ciliate.

Pygidium evenly not strongly convex, with fine remote punctures. Metasternum somewhat thinly clothed with moderately long hair; abdomen with few punctures, these bearing erect hairs and for the most part arranged in a single transverse line on each segment. Protibiae slender, bidentate, and with a very feeble obtuse angulation representing an upper tooth; hind thighs much stouter than the others; claws with a small sharp basal tooth.

Length 10 mm.; width 6.2 mm.

Described from a single male bearing label "San Pedro, Dist. Sur, Baja California, July 5, 1919; G. E. Ferris."

The ventral segments are perceptibly flattened but show no other obvious sexual character. The posterior tibial spurs are

nearly as in the preceding species. This species also belongs in Horn's Group XVIII, and is similar in color to *tusa* and *maculicollis*, but is at once distinguishable by its angulate clypeus from all other species of the group.

LISTROCHELUS

Listrochelus plenus new species.

Oblong, subcylindrical (♂) or a little widened behind (♀); reddish brown, thorax castaneous; elytra pruinose, thorax not at all so; surface apparently glabrous, a few extremely fine and short semierect hairs detectable on the elytra when viewed tangentially.

Front and clypeus moderately coarsely punctate, the latter smooth or with but few punctures postero-medially; clypeal suture not impressed, margin moderately reflexed, feebly emarginate at middle; surface strongly shining in the male, duller in the female.

Prothorax about three-fifths wider than long, base wider than apex, sides strongly subangularly rounded at middle, margin distinctly crenulate anteriorly, feebly so posteriorly; rather loosely and not coarsely punctate, median line imperfectly or incompletely smooth with faint trace of impressed line anteriorly, surface polished.

Elytra rather finely evenly not closely punctate, sutural costa distinct though feebly elevated, first discal costa traceable, the others obsolete.

Body beneath finely sparsely punctate, sterna with rather dense long pilosity.

Length (to elytral apex) 12.5 to 13.25 mm.; width 5.8 to 6.75 mm.

MALE. Antennal club longer than the funicle; ventral segments distinctly flattened at middle, sparsely finely punctate and with moderately long bristling hairs which become more abundant on the median parts of the 5th and 6th segments, where also the punctures become subasperate; 6th segment but little shorter than the 5th. Pygidium strongly convex. Claws almost precisely as in *mucoerus*, the outer claw of the anterior tarsus pectinate along a double margin with a more prominent tooth at apical third; the inner claw and all claws of middle and hind tarsi pectinate along double margin without tooth. Posterior tibial spurs slender, unequal, the longer spur only slightly stouter and less pointed at tip.

FEMALE. Antennal club subequal in length to the funicle; ventral segments convex, very sparsely punctate, almost without hairs except a few recumbent ones toward the sides; 5th segment much longer than in the male and about twice as long as the 6th. Pygidium smaller than in the male, moderately convex, a little flattened medially toward the apex. Anterior claws alike and pectinate along a single margin from base to a moderate acute tooth beyond the middle; middle claws similar to the anterior but very small tooth just beyond the middle and within the pectination. Posterior tibial spurs subequal, a little shorter and less slender than in the male but not at all spatulate.

Southern Arizona (Ajo, one example; Baboquivari Mts., fifteen examples): all collected by O. C. Poling. The type is a male from the last named locality and bears date VII, 1-15, 1923.

This species is closely allied to *mucoreus* but the latter may at once be distinguished by the presence of long hairs at base of thorax and elytra, the lack of the median smooth area of the clypeus, the less flattened ventral surface with absence of erect hairs in the male, and by the presence of a distinct gibbosity at middle of 5th ventral in the female. A comparison of the descriptions will reveal further differences. The unique male type of *obtusius* Lec. differs from the present species by the evenly rounded clypeus, long hairs at base of thorax and elytra, barely visibly flattened venter with complete absence of erect hairs; there is no trace of pruinosity at any part.

Listrochelus juvenilis new species.

Oblong, cylindrical, entirely flavotestaceous; surface without hairs and not in the least pruinose, moderately shining, not perceptibly alutaceous.

Head slightly more than three-fifths as wide as the thorax, clypeus moderately reflexed, truncate with rounded angles, clypeal suture lightly impressed; punctuation coarse, rather close but not crowded.

Prothorax one-half wider than long, sides rounded at middle, thence convergent and nearly straight both to front and rear; base distinctly wider than apex, base angles obtuse with rounded vertices, front angles better defined; surface shining, coarsely loosely punctate, the punctures less numerous medio-basally; disk with two subapical foveiform impressions, two others a little more remote behind the middle, and a smaller or more feeble one near the sides; median line vaguely impressed posteriorly; side margins finely crenulate.

Elytra but little wider than the thorax, sutural costa well defined and with a few fine punctures, discal costæ fine but traceable, punctuation similar to that of the thorax.

Beneath sparsely punctured, each puncture of the metasternum and abdomen bearing a short stiff pointed seta, those of the abdomen being arranged in two fairly regular rows on each segment.

Length 7.25 mm.; width 3 mm.

MALE. Club of antennæ slightly longer than the funicle. Pygidium uniformly flatly convex with a few shallow scattered punctures. Abdomen convex without special sexual modification, the sixth segment much shorter than the fifth. Claws alike on all the feet, a small acute tooth at basal third or two-fifths, between the tooth and the base minutely crenulate.

FEMALE. Unknown.

Baboquivari Mts., Arizona; collected by O. C. Poling.

This little species is the smallest of the genus thus far known from our fauna. It is nearest in size and general facies to *timidus* and is equally destitute of the transverse vertical ridge which is characteristic of the more typical species of the genus. In *timidus* the clypeus is distinctly emarginate, the head densely punctate, thorax densely punctate along the anterior margin and without discal foveæ, ventral segments more numerous and irregularly punctate, claws of male finely serrato-crenulate throughout the greater part of their length.

THYCE

Thyce bidentata new species.

Oblong, subcylindrical, moderately convex; pale brown; vestiture above consisting of short slender lanceolate subsquamiform hairs, pale yellowish in color, with moderately long suberect hair of slightly darker tint on the head and antero-median area of the prothorax. The vestiture does not conceal the surface except nearly so on the head, a sublateral area of the pronotum and on the scutellum.

Clypeal margin rather widely reflexed, sinuato-truncate, the angles well defined, sides subparallel and broadly subangulate curvate. Antennal club a little shorter than the stem; last joint of maxillary palpi twice as long as wide, about two-fifths as long as the antennal club, the excavation moderately deep and occupying the basal two-thirds or more.

Prothorax of usual form, lateral and posterior angles obtuse, rounded; sides straight and subparallel between the obtuse angles; lateral margins more than usually flattened and reflexed; surface smooth and polished between the punctures, which are well separated medially but a little closer at sides.

Elytra three-tenths longer than wide and not quite one-half wider than the prothorax; surface finely subrugulose and indistinctly finely punctate.

Body beneath and vestiture as usual in the genus. Protibiæ bidentate without trace of the usual third upper tooth. Middle tarsus subequal in length to the tibia, hind tarsus just perceptibly shorter than the tibia; tarsal claws on all the feet unequally toothed, the disparity slight on the hind feet.

Length 19.5 mm.; width 9.6 mm.

Described from a single male from Kern Co., California, sent me many years ago as *carpenteri* by Mr. L. E. Ricksecker.

This species differs notably from all previously described in two particulars, *viz.*, the bidentate anterior tibiæ of the male, and the wider subexplanate side margins of the prothorax. On

the basis of the first named peculiarity it may be placed rather empirically between those having the protibia tridentate and the few at the end of the genus with unidentate tibiæ.

In view of the fact that only about half of the twenty-three names assigned by Casey in his last paper on this genus are capable of definite recognition by the student, certain observations seem pertinent. The well known tendency of this author to exaggerate the importance of small differences is nowhere better illustrated than in the series of so called species and subspecies from *vestita* to *pulverea* inclusive in his table. To my way of thinking the nine names here included cover a mixture of more or less trifling individual and local variants which are in no sense valid species. Moreover it is doubtful if anything would be gained by a retention of these names even in a varietal sense, since a study of fifty specimens in my own cabinet all lying within the above limits, prove the characters used to be so far gradational and intercurrent as to almost nullify any attempt at definite identification. As further contributory evidence against the probability of validity it may be added that eight of the nine forms in question bear the same locality label (Los Angeles Co.) and five of the nine were described from uniques.

The first to be described of the above Caseyan species were *pulverea* and *fossiger* (Coleop. Notices I, 1889, p. 170). In the table there given *pulverea* is said to differ from *palpalis* Horn by the denser pubescence and the palpal groove widening toward the base; while *fossiger* is distinct from *palpalis* by the last joint of the maxillary palpi being only very slightly shorter than the antennal club; whereas in *palpalis* the last joint of palpus is said (following Horn) to be three fourths as long as the antennal club, and the groove (judging from Horn's figure) evenly elliptical. As a matter of fact, as I know from an examination of the unique type of *palpalis* in the Horn collection, the terminal joint of the maxillary palpus is fully four-fifths as long as the antennal club and the palpal groove is not evenly elliptical but wider toward the base. This is merely one of a multiplicity of instances of error resulting from a too literal dependence on an earlier description or figure. In this particular case however

the author had no other course since the type was not available for study. The point to be stressed here however is that all of the characters used are variable, between limits of course, within the species, and unless these limits are expressed, characters or measurements drawn from a single example may easily mislead. This point is well illustrated in a series of *blaisdelli* from the type locality (Coronado, Calif.) in my collection, in which the length of the last palpal joint varies from three-fourths as long to almost as long as the antennal club, and the form of the palpal groove is quite inconstant. It therefore became evident to me after studying the type of *palpalis* that *blaisdelli*, *fossiger* and *pulverea* could not be definitely separated therefrom, and a later examination of the Casey types only confirms my impression and impels the inclusion of other more recently described forms as above indicated.

As for the remaining species of the genus, *crenicollis* was vainly described from the female alone and is therefore practically indeterminate because of the difficulty of properly associating the sexes in this genus unless actually taken together. *Squamicollis*, *carpenteri*, *riversi*, *pistoria*, *rotundicauda*, *harfordi*, *squamosa* and *feldi* are unquestionably distinct species and not difficult to identify. *Longipalpis* is very close to *harfordi* but the small differences may be significant if its more northern locality is correct. Of *simplicipes* and *angusticollis* it is difficult to make an estimate without more material; both were described from uniques and *simplicipes* unfortunately lacks the maxillary palpi.

COTALPA

Cotalpa (Pocalta) leonina new species.

Of the usual robust abbreviated form; clypeus black; occiput, prothorax, scutellum and pygidium deep blue, elytra reddish brown; body beneath black, legs black with bluish lustre, the front and middle tibiae medially rufescent, the hind tibiae more completely so. Pubescence ashy white, erect, very fine, long and dense on the head and thorax, still denser at the sides of the body and beneath, sparser on the elytra where it is confined to a basal triangular area and a single row of hairs extending backward on either side of the suture to the apical declivity.

Clypeus semi-elliptical, very densely subrugosely punctate as usual.

Prothorax not quite three-fifths wider than long and two-thirds as wide as the elytra; sides strongly rounded at about the apical third, thence

rapidly converging and just perceptibly arcuate to the front angles, and straight and feebly convergent to the obtuse but well defined hind angles; punctuation fine and dense but not rugose, the punctures narrowly separated to quite in contact; basal marginal line fine, interrupted at middle.

Elytra very nearly as wide as long, sides parallel and broadly arcuate, apex obtusely rounded; surface minutely alutaceous and a little dull; punctuation fine and rather sparse, geminate lines finely impressed but distinct. Pygidium finely sparsely punctate and shining, the punctures a little more numerous toward the sides and base but with scarcely a trace of rugosity.

Length 14.5 mm.; width 8.8 mm.

Described from a single male specimen collected in Antelope Valley in the northern part of Los Angeles Co., California, and has stood in my collection waiting for a name nearly if not quite forty years.

The type is of the same general appearance as *ursina* Horn, but it differs notably from the latter in the form of the prothorax as well as in the very much finer and denser punctuation and longer denser pilosity of this part of the body. In *ursina* the prothorax is more transverse, more shining, much more coarsely and less densely punctured, with the sides more evenly and distinctly arcuate throughout, the point of maximum width at about the middle of the length.

Of the seven species of the *ursina* group of *Cotalpa* described as new by Casey (Memoirs: 1915, p. 92 et seq.) it is hardly possible that more than one or two can be valid. I can see nothing whatever in the diagnoses of *lævicauda*, *brevis* or *rotunda* to warrant a belief in their distinctness from the common and well known *ursina*, within the range of which they all occur. *Rubripennis* and *nigripennis* are certainly color phases of one and the same species, which however because of the average larger size and the bright green thorax with its denser punctuation may well be distinct from *ursina*. The status of *seriata* and *pubicollis* is less obvious, but I believe the latter will prove to be only a varietal form of *granicollis*. It may be positively asserted that the color of the tibiae as used by Casey to delimit *ursina* has no specific weight whatever.

THE MEMBRACIDÆ OF AFRICA

BY FREDERIC W. GODING

As the descriptions of African Membracidæ have appeared in a number of foreign publications and in several languages, some of which are not easily accessible, this paper has been prepared to enable students of the group to identify the numerous genera and species.

A few forms which have not been observed since first described have been included in the genera in which, judging from the published description, they appear to belong.

The subfamily Membracidæ was first recognized as an Old World group by Stål and later by Distant whose opinions are worthy of approval. The division into tribes is for convenience of identification as made plain in the writer's "Classification of the Old World Membracidæ."

The dimensions represent the length from the head to the tips of the tegmina, and the greatest width between the tips of the suprahumeralis if present, and between the humeralis of the unarmed forms.

ÆTHALIONINÆ

*Æthalionini***Coloborrhis**

Germer, Rev. Ent. Silb. iv, p. 72 (1836); *Euryprosopum* Stål, Ofv. Vet. Akad. For. p. 267 (1853); *Bohemia* Stål, Ofv. Vet. Akad. For. p. 97 (1855). *Oclasma* Melichar, Wein. Ent. Zeit. xxiv, p. 293 (1905).

KEY TO SPECIES

- 1(2). Pronotum grayish-testaceous clouded with brown, punctate not granulate; scutellum concolorous, fuscous punctate; 4-5 mm. **corticina**
- 2(1). Pronotum ferruginous with yellow points, densely granulate-punctate, a small black gibba each side near base; abdomen piceous, sides and margins of segments testaceous, first and third segments with a raised median line; scutellum blackish, yellow trilineate; 4.5 mm. **perspicillaris**

LIST OF SPECIES

- corticina** Germar, Rev. Ent. Silb. iv, p. 73 (1836). Cape Colony.
sobrina Stål, Ofv. Vet. Ak. For. p. 97 (1855). Caffraria.
patruelis Stål, Ofv. Vet. Ak. For. p. 98 (1855). Caffraria.
perspicillaris Gerstaecker, Deck. Reis. Ost-Africa, ii, p. 431 (1873). Lake
 Jipe, German East Africa.
degenerata Melichar, Wein. Ent. Zeit. xxiv, p. 294 (1905). Usambara,
 Kwankoro, Kilimanjaro, Kiboscho, German East Africa.
corticina Jacobi, Sjost. Zool. Kil-Meru Exped. II, 1905-6, Hom. p. 123,
 pl. 2, fig. 12 (1910). Kilimanjaro, Meru, Kiboscho, German East
 Africa.

CENTROTINÆ

*Gargarini***Gargara**

- Amyot and Serville, Hemip. p. 537 (1843); *Mærops* Buckton, Mon. Memb.
 p. 257 (1903).

KEY TO SPECIES

- 1(8). Tegmina grayish-hyaline, base and subapical fascia black or brown;
 dorsum straight.
 2(5). Pronotum, base and subapical transverse fascia of tegmina black.
 3(4). Pronotum densely yellow pubescent, posterior apex extended to
 inner angle of tegmina; 4 mm. **variegata**
 4(3). Pronotum slightly pale pilose, posterior apex extended to apex of
 clavus; extreme apical margin of tegmina fuscous; tarsi testace-
 ous; 3 mm. **addahensis**
 5(2). Pronotum and tegminal markings brown.
 6(7). Tegmina much longer than abdomen, semiopaque, base brown, a
 fuscous subapical cloud; pronotum with spots on base, lateral
 margins and apex posterior process, black; abdomen brown,
 margins of segments gray; 3.5 mm. **makalakæ**
 7(6). Tegmina long as abdomen, hyaline, narrow base and broad trans-
 verse median band brown; pronotum brown densely yellow pubes-
 cent, a black spot above each eye; body and abdomen black; 4
 mm. **nyanzai**
 8(1). Tegmina black or brown with paler markings.
 9(15). Pronotum black.
 10(16). Tegmina black with paler areas; slightly pubescent; dorsum
 straight.
 11(14). Tegmina largely black, the paler markings narrow.
 12(13). Tegmina with a transverse subapical vitreous line: 3 mm. **asperula**
 13(12). Tegmina with the apical area pale brown, or a narrow basal fascia:
 6 mm. **aterrima**
 14(11). Tegmina with basal fourth black, apical third purplish, central
 area grayish, sometimes forming two transverse fasciæ; 4 mm.
perpolita

- 15(9). Tegmina bronze-brown, basal area, narrow costal and apical margins, apical area of hind margin, and sometimes a subapical spot, black or piceous; posterior process slightly sinuate, extended to inner angle of tegmina; 6 mm. **ænea**
- 16(10). Pronotum brown, legs paler; dorsum of posterior process distinctly concavely sinuate at middle, apex black, decurved, passing inner angle of tegmina; tegmina pale brown, a suffused gray transverse fascia near base, apical margin and subapical spots paler; 3 mm. **fraterna**

LIST OF SPECIES

- variegata** Signoret, Thoms. Arch. Ent. ii, p. 340 (1858). Calabar, West Africa; Ituri, Central Africa.
- addahensis** Distant, Ann. Mag. N. H. xvi, p. 489 (1915). Addah, Gold Coast.
- makalakæ** Distant, Ins. Transv. i, p. 217, pl. 21, fig. 18 (1908). Mpudzi R., Rhodesia.
- nyanzai** Funkhouser, An. Zool. Mus. Acad. Sci. USSR, xxviii, p. 154, pl. 6, fig. 10 (1927). Bukoba, Victoria Nyanza.
- asperula** Walker, List Hom. B. M. Suppl. p. 162 (1858). Sierra Leone.
- aterrima** Distant, Ann. Mag. N. H. xvi, p. 491 (1915). Uganda, Budongo Forest, Unyoro, Buamba Forest, Semliki Valley, Mabira Forest, Chagwe, East Africa.
- perpolita** Distant, Ann. Mag. N. H. xvi, p. 490 (1915). Uganda, Budongo Forest, Unyoro, Mpanga Forest, Toro, East Africa.
- ænea** Distant, Ann. Mag. N. H. xvi, p. 491 (1915). Uganda, Entebbe, Bogondo, Unyoro, East Africa.
- fraterna** Distant, Ann. Mag. N. H. xvi, p. 490 (1915). Addah, Gold Coast.

Xanthosticta

- Buckton, Mon. Memb. p. 63 (1903); *Tiberianus* Distant, Ann. Mag. N. H. xvi, p. 495 (1915).

KEY TO SPECIES

- 1(2). Pronotum testaceous, disk and posterior process with chest piceous, legs and abdomen testaceous; tegmina hyaline, base and costal margin narrowly piceous or testaceous; 4 mm. **typica**
- 2(1). Pronotum fuscous brown, posterior process tricarinate, its apex distinctly passing apex of clavus; legs brown; tegmina subhyaline, with a yellow macular basal fascia, apical area brown clouded; 5 mm. **bulbacea**

LIST OF SPECIES

- typica** Distant, Ann. Mag. N. H. xvi, p. 494 (1915). Umtali, Rhodesia.
- bulbacea** Distant, Ann. Mag. N. H. xvi, p. 494 (1915). Stellenbosch, Cape Colony.

Kombazana

- Distant, Ins. Transv. i, p. 217 (1908).

KEY TO SPECIES

- One castaneous brown species with black legs; pronotum finely granulose, posterior process sinuate, thick and convexly raised above the scutellum, then straight and more slender to inner angle of tegmina; tegmina semiopaque, apical area brownish ochraceous; tibiae moderately dilated; 4.5-5 mm. **fidelis**

LIST OF SPECIES

fidelis Distant, Ins. Transv. i, p. 218 (1908). Johannesburg, Transvaal.

Promitor

Distant, Ann. Mag. N. H. xvi, p. 495 (1915).

KEY TO SPECIES

- One pale ochraceous species with head, body and legs pale brown, tips of femora and tarsi ochraceous; posterior process robustly recurved to apex of scutellum, then slender, linear and recurved upwardly; tegmina subhyaline with a transverse central and oblique subapical fascia and apical spots fuscous brown; 5 mm. **nominatus**

LIST OF SPECIES

nominatus Distant, Ann. Mag. N. H. xvi, p. 495 (1915). Umkomaas R., Natal.

Umfilianus

Distant, Ann. Mag. N. H. xvi, p. 496 (1915).

KEY TO SPECIES

- 1(2). Entirely black, margins of abdominal segments ochraceous; posterior process strongly arched from base to beyond apex of scutellum, then impinging upon margins of tegmina beyond inner angle, rather slender from base; tegmina subhyaline, basal cells blackish; 6 mm. **declivis**
- 2(1). Piceous, shining, head irrorate, margins of abdominal segments paler; posterior process slender, base strongly curved above the scutellum, sinuate, descending obliquely nearly to tips of tegmina; tegmina base black, then pale yellow, apical third bright yellow, basal half of costa, apical area of longitudinal veins, basal veins of discoidal cells, piceous; scutellum black; 6.75 mm. **fenestratus**

LIST OF SPECIES

declivis Distant, Ann. Mag. N. H. xvi, p. 496 (1915). Umfili R., Mashonaland.

fenestratus Gerstaecker, Deck. Reis. Ost Africa, ii, p. 429 (1873). Endara, German East Africa.

Hamma

Buckton, Trans. Linn. Soc. Lond. Zool. ix, p. 320 (1905).

KEY TO SPECIES

- 1(2). Posterior process rather evenly sinuate and thick, apical area slightly larger, emitting a thick horizontal spine; tegmina hyaline, base piceous, then a pale transverse fascia and small discal diffusions; long vein of clavus extended to the apex; 4 mm.

nodosum

- 2(1). Posterior process heavier and thicker, trilobed, the sinuosities more abrupt, first and second convexities about equal, middle one constricted at the middle, apical area much larger and bulbous without (?) a terminal spine; tegmina hyaline, base brown, small fuscous cloud on the anal angle; long vein of clavus not extended to the apex; 4.5 mm. **mabirensis**

LIST OF SPECIES

nodosum Buckton, Trans. Linn. Soc. Lond. Zool. ix, p. 330, pl. 21, fig. 3 (1905). Cameroons.

pattersoni Distant, Ann. Mag. N. H. xvii, p. 157, fig. on p. 158 (1916); China, Ann. Mag. N. H. (9), xi, p. 463, fig. 3 (1923). Aburi, Ashantee, Gold Coast.

mabirensis China, Ann. Mag. N. H. (9), xi, p. 463, figs. 1 and 2 (1923). Mabira, Uganda, East Africa.

*Centrotini***Eumonocentrus**

Schmidt, Zool. Anz. xxxviii, p. 241 (1911); *Beninia* Distant, Trans. Ent. Soc. Lond. iii, p. 517 (1914).

KEY TO SPECIES

- 1(4). Suprahumerals contiguous nearly to summits; pronotum, abdomen and legs brown; posterior process slightly sinuate; ocelli equidistant, above the center of eyes.

- 2(3). Suprahumerals slightly separated near bases, then contiguous, lateral lobes short, oblique, flat; pronotum unicarinate; tegmina ferruginous-hyaline a brown cloud near apex of clavus; 6.7 mm.

bifurcus

- 3(2). Suprahumerals contiguous from bases, lateral lobes transverse, moderately long, slender; tegmina shining ochraceous; disk of pronotum tricarinate **lamborni**

- 4(1). Suprahumerals contiguous from bases to apical third, lateral lobes diverging, triangular, inclined forward; tegmina amber-hyaline, brown spot near apex of clavus; front and middle tarsi yellow; pronotum reddish-brown, pubescent; ocelli equidistant; 6 mm.

erectus

LIST OF SPECIES

bifurcus Funkhouser, An. Mus. Acad. Sci. USSR, xxviii, p. 148, pl. 5, fig. 4 (1927). Bukoba, Victoria Nyanza.

lamborni Distant, Trans. Ent. Soc. Lond. (3) iii, p. 517 (1914). Oni near Lagos, Coast of N. Nigeria.

erectus Schmidt, Zool. Anz. xxxviii, p. 242 (1911). Fernand-Vaz, French Congo.

Paraxiphopæus

Goding, Am. Mus. Novitates No. 421, p. 26 (1930); Jour. N. Y. Ent. Soc. xxxviii, p. 89 (1930).

KEY TO SPECIES

- 1(6). Posterior process with apical half broad, compressed, arched, apex briefly acute; tegmina three times longer than broad.
- 2(5). Ocelli approaching the eyes; tegmina nearly three times longer than broad; posterior process with a carina on upper and lower margins but without lateral carinæ; legs yellowish; apex scutellum notched.
- 3(4). Black; posterior process nearly horizontal from basal angle to the middle, then moderately convex, longer than but distant from tegmina, apical third oblique, briefly acute; suprahumeral strongly recurved from middle, tips foliaceously dilated, triangular, a carina on the upper surface; tegmina blackish-brown, hyaline spot behind clavus; 10 mm. **schubotzi**
- 4(3). Brown; posterior process strongly convex from basal angle, long as tegmina, apical third nearly perpendicular; suprahumeral slender, equally broad, front and hind margins coarsely granular, nodular on the arched surface, tips acute; pronotal carinæ, nodules, basal half of posterior process, orange-red, middle of hind margin of pronotum, last abdominal segment, and legs yellow; 7-8.5 mm. **gestroi**
- 5(2). Black; ocelli equidistant; posterior process strongly convex from basal angle, cylindrical for basal third, then strongly compressed, broad, apical third perpendicular, long as but distant from tegmina, a strong carina each side, margins serrate; suprahumeral compressed, margins serrate, oblique, strongly curved outward and backward, tips foliaceously dilated, triangular, acute; tegmina four times longer than broad, opaque yellow-brown, long central stripe on apical half, one on clavus, sordid white-hyaline; margins abdominal segments pale; legs yellow; 9 mm. **arebiensis**
- 6(1). Posterior process very slender from base, straight, triquetrous, long as tegmina; pronotum black, hirsute, suprahumeral slender, strongly curved outward and backward, apical fourth triangularly dilated, upper surface reticulate; apex scutellum obtuse; tegmina four times longer than broad, dark brown, base and veins black; ocelli slightly nearer to eyes; 9 x 8 mm.

nodosus Goding

LIST OF SPECIES

schubotzi Jacobi, Wiss. Erg. Deut. Cent.-Afrika. Exped. 1907-8, p. 36, pl. 3, fig. 14 (1912). Ruwenzori, Congo Free State.

- gestroi** Schmidt, Zool. Anz. xxxviii, p. 234 (1911). Fernando Poo Is., Basile, Spanish West Africa.
arebiensis Goding, Jour. N. Y. Ent. Soc. xxxviii, p. 89 (1930). Arebi, New Congo.
nodosus Goding, Am. Mus. Novitates, No. 421, p. 26 (1930). Dar, Sudan, Africa.

Monocentrus

- Melichar, Wein. Ent. Zeit. xxiv, p. 297 (1905). *Basilides* Distant, Ann. Mag. N. H. xvii, p. 149 (1916).

KEY TO SPECIES

- 1(8). Posterior process strongly sinuate, pronotum brown or yellow.
 2(5). Basal angle of posterior process without an anterior tooth; supra-humerals contiguous at least on basal third, the diverging area laminate, half as broad as long, tips acute; scutellum long as broad.
 3(4). Most of pronotum, middle third and tip of posterior process, yellow; tegmina brown-clouded, a hyaline spot at apex of clavus, brown spot on sutural angle; 5-6.5 mm. **laticornis**
 4(3). Pronotum brown, pubescent, narrow tomentose stripe posteriorly each side; tegmina brown with black spots; 4.5-5.5 mm. **deletus**
 5(2). Basal angle of posterior process with a more or less distinct anterior tooth; suprahumeral contiguous at least on basal third, moderately long, narrow, acuminate lateral lobes.
 6(7). Pale brown, except darker tips of the tegmina and fuliginous stain near costa, and ferruginous legs; scutellum longer than broad; 7 mm. **fuscum**
 7(6). Pronotum yellow, white line each side posteriorly, sometimes ferruginous, a broad yellow band between humerals, the supra-humerals beneath and margins yellow, the posterior carinae continued each side to lateral margins; middle of posterior process yellow; scutellum longer than broad; tegmina brown, apical area paler, or yellow with brown apical spot; 4-5 mm. **bipennis**
 8(1). Posterior process nearly straight, basal angle with an anterior tooth; pronotum brown, middle tibiae yellow; ocelli equidistant.
 9(10). Tegmina entirely hyaline, veins yellow, a small brown spot on sutural angle; suprahumeral contiguous on basal two-fifths, then diverging and broadest near acute tips; posterior process lightly convex; a white tomentose line each side posteriorly; scutellum long as broad; ocelli much nearer eyes; 5.5-6 mm. **hyalinipennis**
 10(9). Tegmina opaque brown; ocelli equidistant.
 11(12). Scutellum longer than broad; suprahumeral contiguous at base only, then diverging, moderately broad, acute; tooth at basal angle of posterior process long as broad; tegmina brownish-yellow, bases and spot on middle of costa black; wings smoky-black, bases paler; 7.5 mm. **opacus**

- 12(11). Scutellum long as broad; suprahumeral narrow, briefly contiguous at bases; posterior process slightly sinuate, a small rounded node on basal angle not produced in a tooth; tegmina with central spot and band behind clavus not reaching costa, white; wings colorless hyaline; 6.5 mm. **albomaculatus**

LIST OF SPECIES

- laticornis** Schmidt, Zool. Anz. xxxviii, p. 238 (1911). Barombi, Cameroons.
pharaonus Schmidt, Zool. Anz. xxxviii, p. 239. Barombi, Cameroons.
deletus Melichar, Wein. Ent. Zeit. xxiv, p. 297 (1905). Amani, Bomole, Kibonoto, Kilimanjaro, German East Africa.
fuscum Buckton, Trans. Lin. Soc. Lond. Zool. ix, p. 334, pl. 22, fig. 2 (1905). Cameroons.
bipennis Walker, List Hom. B. M. p. 606 (1851). Old Calabar, Cameroons.
albolineatum Buckton, Mon. Memb. p. 216, pl. 48, fig. 6 (1903). Ograga, Niger R., West Africa.
insularis Schmidt, Zool. Anz. xxxviii, p. 239 (1911). Fernando Poo Is., Spanish West Africa.
hyalinipennis Schmidt, Zool. Anz. xxxviii, p. 240 (1911). Fernand-Vaz, Cameroons.
opacus Schmidt, Zool. Anz. xxxviii, p. 239 (1911). Fernando Poo Is., Moca, Spanish West Africa
albomaculatus Schmidt, Zool. Anz. xxxviii, p. 240 (1911). Cameroons.

Anchon

- Buckton, Mon. Memb. p. 214 (1903).

KEY TO SPECIES

- 1(4). Basal angle of posterior process without an anterior tooth; suprahumeral oblique, tips dilated, subtruncate.
 2(3). Pronotum ferrugino-fuscous, granulose, a pubescent line each side posteriorly; posterior process straight from basal angle; tegmina fusco-ferruginous subhyaline; 7 mm. **bilineatus**
 3(2). Pronotum black, punctate, not granulose; posterior process depressed at middle; tegmina smoky-hyaline, base and interior apical margin brown; 7 mm. **gunni**
 4(1). Basal angle of posterior process without an anterior tooth; suprahumeral oblique, tips dilated, subtruncate.
 5(14). Posterior process sinuate.
 6(11). Tegmina yellowish-hyaline; tarsi yellowish.
 7(10). Surface of pronotum granulate, black or brown.
 8(9). Basal tooth of posterior process very prominent, directed forward, basal area of posterior process robust; tegmina with base, median costal spot, spot behind clavus, and transverse apical veins, dark brown; 5.5 mm. **aries**

- 9(8). Basal tooth of posterior process barely evident; suprahumeral carinate on upper surface; tegmina with base, median costal spot, brown; abdomen gray, black punctate; 5 mm. **minor**
- 10(7). Surface of pronotum punctate, not granulate; form slender; black, stripe each side posteriorly and sides of chest pubescent; margins of abdominal segments yellow; tegmina with base, spot on middle of costa and apical margin, dark-brown; 5.5-6.5 mm. **gracilis**
- 11(6). Tegmina black or dark brown, tarsi yellowish; tips suprahumeral broadened, briefly acute.
- 12(13). Surface of pronotum granular, base of posterior process robust; stripe each side posteriorly and chest pubescent; base of tegmina, costa and limbus, black, transverse median hyaline median band; 6 mm. **dschagga**
- 13(12). Surface of pronotum punctate, not granular, black, median carina castaneous, stripe each side posteriorly and scutellum pubescent; tegmina with small pale spot on apex of clavus and exterior half of apical area ochraceous; 5.6 mm. **decoratum**
- 14(5). Posterior process straight or nearly straight from basal angle.
- 15(20). Legs yellow; pronotum reddish-brown or black.
- 16(17). Posterior process lightly arched from basal angle to apex; tegmina dark-brown, base, median costal spot and tips reddish or piceous; 5.5-6 mm. **flavipes**
- 17(16). Posterior process straight from basal angle; pubescent; tegmina infusate.
- 18(19). Suprahumeral slender at bases, margins rough, summits compressed, angular, acuminate; stripe each side posteriorly, basal angles of scutellum, and sides chest pubescent; tegmina with a pale spot behind clavus; 6 mm. **senegalensis**
- 19(18). Suprahumeral broader, more expanded, tips more obtuse; weakly pubescent; base of tegmina, costa and apical limbus fuscous; 5 mm. **vicinus**
- 20(15). Legs black; pronotum black or brown.
- 21(24). Bases of suprahumeral distant, a pubescent line behind each.
- 22(23). Tegmina hyaline, base, median costal spot, and apical margin dark brown; tarsi brown; ocelli equidistant; 6-7 mm. **limbatum**
- 23(22). Tegmina pale testaceous, apical margin darker, base and costa piceous; tarsi ferruginous; ocelli nearer to eyes; 7-8.5 mm. **nodicornis**
- 24(21). Bases of suprahumeral slender, not distant, margins serrate; tegmina sordid hyaline; 5 mm. **proximus**

LIST OF SPECIES

- bilineatus** Stål, Ofv. Vet. Ak. Forh. p. 95 (1855). Natal, Caffraria.
- gunni** Funkhouser, Can. Ent. li, p. 220, pl. 19, figs. 1-2 (1919). Pretoria, Transvaal.

- aries** Jacobi, Sjost. Zool. Kil-Meru Exped. II, 1905-6, Hom. p. 122, pl. 2, fig. 4 (1910). Kilimanjaro, Kibonoto, Meru, East Africa.
- minor** Melichar, Wein. Ent. Zeit. xxiv, p. 296 (1905). Bomole, East Africa.
- gracilis** Schmidt, Zool. Anz. xxxviii, p. 236 (1911). Fernando Poo Is., Moca, Spanish West Africa.
- dschagga** Jacobi, Sjost. Zool. Kil-Meru Exped. II, 1905-6, Hom. p. 122, pl. 2, fig. 4 (1910). Usambara, Mombo, Kilimanjaro, Kibonoto, E. Africa.
- decoratum** Distant, Trans. Ent. Soc. Lond. (3) iii, p. 516 (1914). Oni near Lagos, N. Nigeria.
- relatum** Distant, Trans. Ent. Soc. Lond. iii, p. 516 (1914). Oni near Lagos, N. Nigeria.
- flavipes** Schmidt, Zool. Anz. xxxviii, p. 237 (1911). Victoria Nyanza, Arcip. di Sesse, Bugala, Musola, East Africa.
- ? remigium** Buckton, Mon. Memb. p. 215, pl. 48, fig. 5 (1903). Unknown.
- senegalensis** Fairmaire, Rev. Memb. p. 511 (1846). Senegal, Fernando Poo Is., West Africa.
- vicinus** Signoret, Thoms. Archiv. ii, p. 339 (1858). Gabon, Calabar.
- limbatum** Schmidt, Zool. Anz. xxxviii, p. 235 (1911). Victoria Nyanza, Uganda, Archip. di Sesse, Bugala, Busu Busorga, East Africa.
- nodicornis** Germar, Rev. Ent. Silb. iii, p. 257 (1835); Fairmaire, Rev. Memb. p. 511, pl. 3, fig. 13 (1846); Buckton, Mon. Memb. p. 215, pl. 48, fig. 1 (1903); Distant, Ins. Transv. i, p. 216, pl. 21, fig. 19 (1908). Cape Colony; Durban; Krentz Kloof, Natal, S. Africa. Bomole, Kilimanjaro, Kibonoto, Melsetter, Gazaland, Rhodesia.
- proximus** Signoret, Ann. Soc. Ent. Fr. (3) viii, p. 202 (1860). Madagascar Is.

Spalirises

- Distant, Ann. Mag. N. H. xviii, p. 29 (1916).

KEY TO SPECIES

- 1(4). Suprahumeral transverse, short, robust, acuminate; posterior process strongly robustly elevated at base in angle, leaving the scutellum exposed, then deeply concave to behind scutellum and sinuate, extended to interior angle of tegmina; ocelli near eyes.
- 2(3). Black, rugose, pubescent; disk of pronotum higher than suprahumeral, median carina strong; tegmina translucent ferruginous, a transverse median hyaline fascia; legs brown, tarsi yellow; 7-8 mm. **rugosa**
- 3(2). Dark brown to black, not rugose, body and legs yellow pubescent; disk of pronotum lower than suprahumeral, median carina very acute anteriorly; tegmina dark vinaceous with two transverse hyaline bands; dorsal carina of posterior process serrate; 8 mm. **alticornis**
- 4(1). Suprahumeral long, rather slender, directed obliquely upward and forward, prismatic; base of posterior process weakly but dis-

tinely elevated in an obtuse angle, near and touching apex of scutellum, then sinuate passing interior angle and following margins of the tegmina; ocelli equidistant; 7-8 mm. **humilis**

LIST OF SPECIES

- rugosa** Funkhouser, An. Mus. Zool. Acad. Sci. USSR, xxviii, p. 149, pl. 5, fig. 5 (1927). Bugombe near Bukoba, Victoria Nyanza.
- alticornis** Jacobi, Sjost. Zool. Kil-Meru Exped. II, 1905-6, Hom. p. 122; Wiss. Erg. Deut. Cent-Afrik. Exped. 1907-8, p. 35, fig. A, a (1912). Meru, Usambara, Kericho, Uganda, Mentanda, Mpanga Forest.
- humilis** Goding, Jour. N. Y. Ent. Soc. xxxviii, p. 89 (1930). Ruwenzori, Central Africa.
- alticornis* Jacobi, (variety), Wiss. Erg. Deutch. Cent-Afrik. Exped. 1907-8, p. 35, fig. A, b-c (1912). Ruwenzori, Central Africa.

Planecornua

Goding, Jour. N. Y. Ent. Soc. xxxviii, p. 90 (1930).

KEY TO SPECIES

One piceous pubescent species with two spots on the metopidium, stripe behind each suprahumeral, base of scutellum, and sides of chest, pubescent; scutellum slightly longer than broad; tegmina dark vinaceous, the base, median costal spot, and large spot behind clavus, dark brown; tarsi ferruginous yellow; 7-7.5 mm. **infractus**

LIST OF SPECIES

- infractus** Jacobi, Sjost. Zool. Kil-Meru Exped. II, 1905-6, Hom. p. 122, pl. 2, fig. 5 (1910). Kilimanjaro, Kibonoto, East Africa.

Centrotus

Fabricius, Syst. Rhyng. p. 18 (1803); *Beaufortiana* Distant, Ann. Mag. N. H. xviii, p. 30 (1916).

KEY TO SPECIES

- 1(8). Posterior process emitted from high above the hind margin of pronotum, distant from the scutellum; suprahumeral subhorizontal, acuminate, tips decurved; pronotum black or brown.
- 2(7). Posterior process distinctly sinuate or undate, with a basal tooth or node more or less evident.
- 3(4). Posterior process moderately slender, strongly undate, basal node prominent; suprahumeral short, slender; basal half of tegmina fuscous, apical half decolored; 5 mm. **flagillifer**
- 4(3). Posterior process moderately sinuate, basal node slightly elevated.
- 5(6). Suprahumeral robust, transverse; posterior process robust on basal half, not impinging on the tegmina, apical area strongly decurved; tegmina reddish-fuscous; 8 mm. **serpentarius**

- 6(5). Suprahumeral moderately slender, lightly inclined forward; posterior process moderately slender, impinging upon the tegmina behind apex of scutellum, apical area substraight; tegmina dark yellow, veins hairy; 8 mm. **subnodosus**
- 7(2). Posterior process slender, straight, base not dentate, not touching margins of tegmina; tegmina vitreous, a fascia behind clavus and middle of apical margin fuscous; 4-4.5 mm. **varipennis**
- 8(1). Posterior process emitted from near hind margin of pronotum, more or less curved at base and usually distinctly separated from the scutellum, then straight or substraight; suprahumeral horizontal.
- 9(12). Apex of posterior process distinctly decurved; tegmina subhyaline, base black, apical area bronzy-brown.
- 10(11). Ochraceous; suprahumeral broad, substraight, tips black margined, obliquely truncate and bicarinate; 8.5 mm. **laxatus**
- 11(10). Black, chest white, tomentose; suprahumeral slender, ventrally carinate, tips recurved, acute; 7-8 mm. **bovinus**
- 12(9). Apex of posterior process substraight.
- 13(14). Posterior process impinging upon the scutellum, continued slightly above margins of tegmina; suprahumeral broad, tips obliquely truncate, angulate posteriorly; tegmina pale bronzy, base black; 9-9.5 mm. **bantuantus**
- 14(13). Posterior process distinctly separated from the scutellum.
- 15(20). Black or brown; posterior process straight.
- 16(17). Black, a spot behind each suprahumeral, basal angles of scutellum, and sides of chest, white pubescent; suprahumeral medium; tegmina vinaceous, the base, costa, apex of clavus and spot behind it, fuscous; 5-7 mm. **quadripunctatus**
- 17(16). Dark- or reddish-brown.
- 18(19). Dark ferruginous-brown, tibiae and tarsi testaceous, sides of chest tomentose; suprahumeral transverse, rather short and robust, tips acute; tegmina subhyaline, base brown; 8 mm. **shoanus**
- 19(18). Reddish-brown; suprahumeral rather long, suboblique, tips recurved, acute; tegmina subhyaline, base ochraceous; 4-5.5 mm. **difficilis**
- 20(15). Ochraceous; posterior process moderately undulate, impinging upon margins of tegmina behind the scutellum; suprahumeral broad, some narrowed to the obliquely truncate recurved tips; tegmina subhyaline, base black, apical area bronze; 6-7 mm. **rugosus**

LIST OF SPECIES

- flagillifer** Signoret, Thoms. Archiv. Ent. ii, p. 336, pl. 11, fig. 14 (1858). Calabar.
- varipennis** Buckton, Mon. Memb. p. 250, pl. 57, fig. 1 (1903). Calabar; Sagital, Usambara, Kwankarro, near Victoria Nyanza.
- minor** Buckton, Trans. Lin. Soc. Lond. ix, p. 335 (1905). Cameroons.

- serpentarius** Buckton, Trans. Lin. Soc. Lond. ix, p. 335, pl. 22, fig. 7 (1905). Cameroons.
- subnodosus** Jacobi, Wiss. Erg. Deut. Cent-Afrik. Exped. 1907-8, p. 35, pl. 3, fig. 13 (1912). Ruwenzori, Kiwu-Sea, Central Africa.
- varipennis** Signoret, Thoms, Archiv. Ent. ii, p. 337 (1858). Calabar.
- laxatus** Distant, Ann. Mag. N. H. xvii, p. 155 (1916). Durban, Natal.
- bovinus** Distant, Ann. Mag. N. H. xvii, p. 323 (1916). Kandunguru, Uganda, Mumias.
- bantuansus** Distant, Ins. Transv. i, p. 215, pl. 21, fig. 13 (1908). Waterburg, Pretoria, Transvaal; Durban, Natal; Umtali, Rhodesia.
- quadripunctatus** Stål, (♀), Ofv. K. Vet. Ak. For. p. 94 (1855). Caffraria, Natal.
- ? *hamifer* Walker, List Hom. B. M. Suppl. p. 159 (1858). Port Natal.
- spiniornis* Stål, (♂), Of. K. Vet. Ak. For. p. 95 (1855). Caffraria, Natal.
- shoanus** Distant, Ann. Mag. N. H. xvii, p. 323 (1916). Shoa, Abyssinia.
- difficilis** Distant, Ann. Mag. N. H. xviii, p. 31 (1916). Beaufort West, Cape Colony.
- cornuta* Distant, Ann. Mag. N. H. xviii, p. 31 (1916). Beaufort West, Cape Colony.
- rugosus** Buckton, Mon. Memb. p. 243, pl. 56, fig. 3 (1903). Kibotini, East Africa.
- marshalli* Distant, Ann. Mag. N. H. xvii, p. 154 (1916). Salisbury, Umfili R., Mashonaland; Kibotini, East Africa.

Tricoceps

- Buckton, Mon. Memb. p. 249 (1903); *Tambusa* Distant, Ins. Transv. i, p. 216; *Tambusana* Distant, Ann. Mag. N. H. ix, p. 652 (1912).

KEY TO SPECIES

- 1(4). Black, not pubescent; suprahumeral moderately long, horizontal, recurved; posterior process not thick at base; legs black.
- 3(3). Tegmina fusco-diaphanous, base and median spot on costa black; suprahumeral lightly recurved, tricarinate above; apex of scutellum flat; 7 mm. **brunnicornis**
- 3(2). Tegmina bronzy-brown, base and a line on costa black, brown spot on posterior angle; suprahumeral not carinate above, longer, stronger recurved; apex scutellum curved upward; 5-6 mm. **curvispina**
- 4(1). Piceous or ferruginous, gray tomentose, body black, segmental margins of abdomen gray, tibiae brown, tarsi yellow; suprahumeral medium, transverse, tips slightly recurved, a carina above; posterior process thick at base; tegmina semiopaque, veins pubescent, a dark spot near apex of clavus, apical area brownish-yellow; 4.5-6 mm. **pubipennis**

LIST OF SPECIES

- brunnipennis** Germar, Rev. Ent. Silb. iii, p. 257 (1835); Buckton, Mon. Memb. p. 249, pl. 56, fig. 8 (1903). Natal, Cape of Good Hope.
- curvispina** Distant, Ann. Mag. N. H. xvii, p. 322 (1916). Katanga, Kambove, Congo Free State.
- pubipennis** Fairmaire, Rev. Memb. p. 511 (1846); Distant, Ins. Transv. i, p. 216, pl. 21, fig. 17 (1908). Durban, Port Elizabeth, Natal; Caffraria; Cape of Good Hope.

Centrotusoides

Distant, Ann. Mag. N. H. xviii, p. 29 (1916).

KEY TO SPECIES

- 1(2). Tips of suprahumeral acuminate, recurved; 6.5 mm..... **muiri**
- 2(1). Tips of suprahumeral broadly truncate, not recurved; 6.5 mm. **weali**

LIST OF SPECIES

- muiri** Distant, Ann. Mag. N. H. xviii, p. 30 (1916). Durban, Natal.
- weali** Distant, Ann. Mag. N. H. xviii, p. 30 (1916). South Africa.

Platybelus

Stal, Hemip. Afric. iv, p. 96 (1866).

KEY TO SPECIES

- 1(6). Posterior process emitted high above the hind margin of pronotum, very distant from the scutellum; black or brown.
- 2(3). Dorsum of posterior process with a tooth at base; suprahumeral twice longer than between their bases, slender, curved upward, outward and strongly backward, tips acute; tegmina fusco-hyaline, hyaline spot behind apex of clavus; dark brown with white tomentose patches, tarsal yellowish; 6.5 mm..... **albescens**
- 3(2). Dorsum of posterior process without a basal tooth, more or less touching margins of tegmina.
- 4(5). Suprahumeral short, recurved, tips decurved; posterior process nearly long as tegmina, dorsum not serrate; tegmina brownish-ochraceous suffused with piceous-brown; legs brownish-yellow; thickly yellow pilose; 8 mm..... **sinuosus**
- 5(4). Suprahumeral medium, recurved, acuminate; posterior process robust at base, then slender, its dorsum finely serrate, the apex passing apex of clavus; tegmina subhyaline, basal area, broad central fascia and a narrow curved subapical fascia purplish-brown, apical margin yellow; legs piceous; 7 mm..... **escaleranus**
- 6(1). Posterior process emitted from near hind margin of the pronotum, sinuate, separated but not strongly elevated from the body, its base oblique, not angulate.

- 7(8). Suprahumerals broad, compressed, curved upward, slightly forward and outward, tips expanded, not acute; pronotum yellow, pubescent, chest brown; posterior process slender, slightly curved, near the abdomen; tegmina subhyaline, spot behind clavus and apex fuscous; 5 mm. **flavus**
- 8(7). Suprahumerals gradually acuminate; brown or black.
- 9(12). Legs blackish-brown.
- 10(11). Tegmina yellow, basal and costal cells black; 7 mm. **gowdeyi**
- 11(10). Tegmina dark-yellow, base and spot near clavus castaneous, an obscure pale macular band behind middle; disk of pronotum with two pubescent lines; 7 mm. **africanus**
- 12(9). Legs black, tarsi yellow; suprahumerals robust; posterior process robustly arched above scutellum, then slender impinging upon margins of tegmina; tegmina pale yellow, the base and costa black, a brown spot behind clavus; 5 mm. **insignis**

LIST OF SPECIES

- albescens** Funkhouser, An. Mus. Acad. Sci. USSR, xxviii, p. 146, pl. 5, fig. 2 (1927). Zanzibar.
- sinuosus** Distant, Ann. Mag. N. H. xvii, p. 155 (1916). Nyasaland.
- escalaranus** Distant, Ann. Mag. N. H. xvii, p. 324 (1916). Cameroons.
- flavus** Signoret, Thoms. Archiv. Ent. ii, p. 339 (1858). Calabar, Gabon.
- africanus** Distant, Ann. Mag. N. H. xvii, p. 325 (1916). Cameroons; Buamba Forest, Semliki Valley, Budongo Forest, Unyoro, Uganda.
- insignis** Distant, Ann. Mag. N. H. xvii, p. 326 (1916). Lake Nyassa, East Africa.

Evanchon

- Goding, Jour. N. Y. Ent. Soc. xxxviii, p. 40 (1930); *Maguva* Melichar and *Anchonoidea* Distant (part).

KEY TO SPECIES

- One small black densely pubescent species with suprahumerals thick, horizontal, short, quadricarinate, tips acute; posterior process slender, base curved high above the scutellum, shorter than the abdomen; tegmina smoky hyaline, base brown, spot at tip of costal cell and one behind clavus ferruginous; tarsi yellow; 5 mm. **minutus**

LIST OF SPECIES

- minutus** Funkhouser, Can. Ent. li, p. 221, pl. 19, figs. 3-4 (1919). Pretoria, Transvaal.

Amitrochates

- Distant, Ann. Mag. N. H. xvii, p. 327 (1916).

KEY TO SPECIES

- One shining black species, margins of posterior process coarsely serrate, tegmina pale hyaline, basal area black; tibiae and tarsi yellow, base of tibiae black; abdomen gray; 7-7.5 mm. **grahami**

LIST OF SPECIES

grahami Distant, Ann. Mag. N. H. xvii, p. 328, text fig. (1916). Ashanti, Obuasi, Aburi, Gold Coast.

Barsumas

Distant, Ann. Mag. N. H. xvii, p. 156 (1916).

KEY TO SPECIES

One testaceous or brown species covered with spinules; suprahumeral short, broad, slightly raised, margins serrate, tips abruptly acute; posterior process strongly bisinuate, broadened near middle, not near the tegmina, apex yellow; tegmina subhyaline with irregular markings and apical margin castaneous; 5 mm. **primus**

LIST OF SPECIES

primus Distant, Ann. Mag. N. H. xvii, p. 156 (1916). Salisbury, Mashonaland.

*Uroxiphini***Uroxiphus**

Amyot and Serville, Hemip. p. 550 (1843).

KEY TO SPECIES

- 1(2). Pronotum and legs black, scutellum yellow, apex black; tegmina ferruginous brown, line at base and claval spot yellow; base of head not tuberculate; 8 mm. **maculiscutum**
 2(1). Pronotum ferruginous, scabrous, two basal impressions; scutellum ferruginous, body black, tibiae and tarsi paler; tegmina ferruginous; head black, elongate tubercle each side at base; 6 mm. **simplex**

LIST OF SPECIES

maculiscutum Amyot and Serville, Hemip. p. 550, pl. 12, fig. 9 (1843). Senegal.

simplex Walker, Ins. Saund. Hom. p. 78 (1858). Cape Colony.

Melicharella

Goding, Jour. N. Y. Ent. Soc. xxxviii, p. 40 (1930); *Machærotypus* Melichar, Hom. Ceylon, p. 125 (1903).

KEY TO SPECIES

- 1(2). Bluish black, abdomen black segmental margins paler, legs reddish, body pubescent; tegmina reddish brown, base piceous; ocelli near eyes; 8 mm. **montana**
 2(1). Ferruginous or black, slightly pubescent, legs ferruginous; tegmina decolored, base pale yellow, rarely an obsolete suprahumeral tubercle; 4.5 mm. **albipennis**

LIST OF SPECIES

- montana** Jacobi, Sjost. Zool. Kil-Meru Exped. II, 1905-6, Hom. p. 120 (1910). Meru, Usambara, Nguelo, Kilimanjaro, Kimbonoto, Kiboscho, E. Africa.
- albipennis** Stål, Hemip. Afrie. iv, p. 89 (1866). Caffraria, S. Africa.

Awania

Distant, Trans. Ent. Soc. Lond. (3), iii, p. 518 (1914).

KEY TO SPECIES

- 1(4). Basal margin of pronotum not produced above the head, posterior process well elevated above the scutellum not touching tegmina, slender beyond base; ocelli equidistant no carina between.
- 2(3). Pronotum and legs black, middle tibiae and base of tarsi pale brown; tegmina pale ochraceous; posterior process concavely sinuate; 7 mm. **typica**
- 3(2). Pronotum and legs piceous brown, hind tarsi yellowish; tegmina hyaline, cells brown clouded; posterior process straight; 8 mm. **bigibbosa**
- 4(1). Basal margin of pronotum produced above the head, two smooth spots above eyes; posterior process very slender from extreme base, lightly sinuate, slightly arched above scutellum touching tegmina beyond; tegmina vinaceous hyaline; pronotum and legs black; ocelli nearer to eyes a longitudinal carina between; 7 mm. **vicina**

LIST OF SPECIES

- typica** Distant, Trans. Ent. Soc. Lond. (3), iii, p. 518 (1914). Oni near Lagos, Ashantee, W. Africa.
- bigibbosa** Schmidt, Stet. Ent. Zeit. lxxii, p. 276 (1911): Buea, Cameroons.
- vicina** Goding, Jour. N. Y. Ent. Soc. xxxviii, p. 30 (1930). Gombari, French Congo.

Demanga

Distant, Faun. Brit. Ind. iv, p. 69 (1908).

KEY TO SPECIES

- 1(2). Entirely shining black; tegmina bronzy brown, extreme base black with transverse yellow macular fascia, costal area piceous; 6.5 mm. **deflectens**
- 2(1). Shining black, scutellum yellow base brown, tarsi brown hind tarsi yellowish, margins abdominal segments pale; tegmina hyaline, base opaque brown, central area whitish transparent, apical third brown clouded, spot in clavus and in corium yellow; 7.5-9 mm. **occidentalis**

LIST OF SPECIES

- deflectens** Distant, Ann. Mag. N. H. xvi, p. 494 (1915). Njaro Narok, Kenya, Ruanda, Nyeri Road, E. Africa.

occidentalis Schmidt, Stet. Ent. Zeit. lxxii, p. 275 (1911). Bolama, Rio Cassini, Portuguese Guinea, W. Africa.

Leptocentrini

Xiphopoeus

Stal, Hemip. Afric. iv, p. 91 (1866); *Kleidosis* Buckton, Mon. Memb. p. 214 (1903).

KEY TO SPECIES

- 1(8). Basal angle of posterior process uni- or bidentate.
- 2(3). Basal angle of posterior process bidentate; suprahumeral nearly erect, straight, robust, tips amplified, angularly truncate and bifid; tegmina pale fuscous; 9 mm. **vomeris**
- 3(2). Basal angle of posterior process unidentate; suprahumeral nearly erect, tips usually amplified.
- 4(5). Suprahumeral moderately slender on basal half, apical half strongly curved backward, tips trispinose; apical third posterior process concavely curved backwards gradually acuminate; tegmina gray hyaline, tips fuscous spotted, apical angle obtuse; 7 mm. **phantasma**
- 5(4). Suprahumeral robust, heavy.
- 6(7). Suprahumeral strongly obliquely divaricate, a carina behind each, tips amplified, flat, recurved; posterior process more nearly straight, apical area more slender; tegmina sordid hyaline, veins rough, apical area fuscous spotted; tibiae and tarsi yellowish; 7 mm. **validicornis**
- 7(6). Suprahumeral nearly erect, slightly diverging, tips not or slightly broadened and obliquely truncate, not recurved; posterior process strongly convex, broad nearly to apex; tegmina dark brown, tips rufous; legs black; 9 mm. **palmatus**
- 8(1). Basal angle of posterior process without an anterior tooth.
- 9(10). Suprahumeral obliquely erect, inwardly coarsely serrate, tips broadened, flat, bispinose; 6.5 mm. **erectus**
- 10(9). Suprahumeral slightly elevated, nearly transverse, tips depressed, flat, triangular, tridentate, recurved; 7-8 mm. **horridulus**

LIST OF SPECIES

- vomeris** Buckton, Mon. Memb. p. 214, pl. 48, fig. 2 (1903). Calabar.
- phantasma** Signoret, Thoms. Archiv. Ent. ii, p. 328, pl. 11, fig. 13 (1858). Calabar; Albert-Sea, Kassenque, Congo Free State.
- validicornis** Stål, Ofv. Vet. Ak. Forh. p. 95 (1855). Caffraria, Natal.
- palmatus** Buckton, Trans. Linn. Soc. Lond. Zool. ix, p. 333 (1905). Zanzibar.
- vomeris* Melichar, Wein Ent. Zeit. xxiv, p. 296 (1905). Tanga, Bomole, Usambara, E. Africa.
- erectus** Distant Ann. Mag. N. H. xvii, p. 152 (1916). Kafu R., Kampala Road, Hoima, Lake Isolt, Uganda.

horridulus Walker, List Hom. B. M. p. 605 (1851); Distant, Ins. Transv. i, p. 215, pl. 21, fig. 10 (1908). Natal, Caffraria; Buzi R., Gazaland, Rhodesia.

Euxiphopœus

Goding, Jour. N. Y. Ent. Soc. xxxviii, p. 91 (1930); *Xiphopœus* section *aa*, Stal, Hemip. Afric. iv, p. 92 (1866).

KEY TO SPECIES

- 1(2). Posterior process long as abdomen; suprahumeral not tuberculate; veins of tegmina nodulate; 6 mm. **geniculatus**
- 2(1). Posterior process nearly long as tegmina; suprahumeral covered with tubercles; veins of tegmina smooth; 5 mm. **hirculus**

LIST OF SPECIES

geniculatus Stål, Hemip. Afric. iv, p. 92 (1866). Sierra Leone, W. Africa.
hirculus Jacobi, Sjost. Zool. Kil-Meru Exped. II, 1905-6, Hom. p. 121, pl. 2, fig. 8 (1910). Kilimanjaro, Kibonoto, E. Africa.

Leptocentrus

Stal, Hemip. Afric. iv, p. 86 (1866); *Rabduchus* Buckton, Mon. Memb. p. 251; *Bocchar* Jacobi, Sjost. Zool. Kil-Meru Exped. II, 1905-6, Hom. p. 120 (1910), (part).

KEY TO SPECIES

- 1(22). Apex of posterior process far passing apex of clavus.
- 2(15). Suprahumeral horizontal or subhorizontal.
- 3(14). Pronotum blue black or black; suprahumeral short, slender; posterior process straight from basal curve.
- 4(7). Entirely blue black, yellow pubescent; median carina weak; suprahumeral shorter than intermediate space, slender.
- 5(6). Disk of pronotum moderately elevated, base of posterior process slightly convex; abdomen black, segmental margins pale; tegmina vinaceous, smoky spot behind clavus; 7.5-8.5 mm. **montanus**
- 6(5). Disk of pronotum robustly raised, base of posterior process strongly convex; abdomen blue black; tegmina subhyaline, base brown, apical margin bronzy yellow; 7 x 4 mm. **thelwalli**
- 7(4). Entirely black.
- 8(13). Posterior process distant from and its tip only touching margins of tegmina.
- 9(12). Suprahumeral directed outwardly, tips slightly recurved.
- 10(11). Metopidium vertical; yellow pubescent; tegmina pale lurid, base black; 7.5-9.5 mm. **altifrons**
- 11(10). Metopidium obliquely convex, highest posteriorly; slightly pubescent; tegmina ferruginous hyaline; 7-10 x 3-4 mm. **lama**
- 12(9). Suprahumeral directed backwardly, straight; not pubescent; tegmina subhyaline pale brownish yellow, large ochraceous basal spot; 7-7.5 x 5 mm. **aureomaculatus**

- 13(8). Posterior process distinctly sinuate, moderately distant from, and its decurved apical half impinging upon margins of tegmina, a small node at base; suprahumeral recurved, upper surface carinate; tegmina vinaceous, exterior half for three-fourths the length chestnut brown; 10 mm. **limbipennis**
- 14(3). Castaneous brown; suprahumeral broad, robust with strong median carina; posterior process moderately sinuate; tegmina pale bronzy brown, base brown, then a transverse pale yellow macular fascia; 9-10 x 5-6 mm. **grossus**
- 15(2). Suprahumeral oblique.
- 16(21). Expanse of suprahumeral equal to about one-half total length to tips of tegmina.
- 17(20). Black; suprahumeral moderately oblique.
- 18(19). Tegmina colorless hyaline, basal fourth black, opaque, punctate, an obsolete yellow cloud on exterior margin toward tips, veins black, hairy; exterior vein of clavus straight to obtuse apex; wings with four apical cells. Entirely black, densely coarsely punctate with fine pale pubescence; tarsi yellowish brown. Head densely pubescent, base sinuate, ocelli large, prominent, nearer to and even with center of eyes; apical margin transverse, clypeus almost wholly extended below, tip obtuse. Pronotum well elevated, metopidium vertical slightly convex at apex; humeral large, conical, acute; suprahumeral robust at base, gradually acuminate, concavely curved upward, several weak carinae on apical area, apical half recurved; posterior process about even with and continuous with disk of pronotum, not convexly elevated, sinuous, tricarinate, apical third impinging upon margins of tegmina to the apex of fifth apical cell. Scutellum long as broad, quadrate, apex crenate. Type, female, 10 x 6 mm. from Arebi, Africa. An example from Dungu, Africa is mutilated.
arebiensis, n. sp.
- 19(18). Tegmina bronzy brown, a large fasciate subapical ochraceous spot, base, costal area and apical margin black; ocelli nearer to and even with upper margins of eyes; suprahumeral medium, convexly recurved, with a strong central carina; entirely black; 8.5-9 x 4.5-5 mm. **ugandensis**
- 20(17). Dark brown; suprahumeral strongly oblique, nearly erect, straight; tegmina brown, a large reddish yellow spot on apical area; 8 x 4 mm. **rufipennis**
- 21(16). Expanse of suprahumeral equal to the total length to tips of tegmina, roundly curved, tips carinate, recurved; black, tarsi testaceous; tegmina pale brownish yellow; 9 x 9 mm. **peracatus**
- 22(1). Apex of posterior process not or slightly passing apex of clavus; suprahumeral short, medium, horizontal; chest tomentose.
- 23(24). Shining blue black; ocelli widely separated; abdomen black, margins paler, tibiae and tarsi reddish brown; suprahumeral

- very short; tegmina reddish brown, base piceous brown, veinless apical margin smoky; 7.5 mm. **confusus**
 24(23). Black or piceous, tibiae ochraceous; suprahumeral medium short, tips recurved; tegmina pale bronzy brown, base reddish; 5.5-6 x 3-3.5 mm. **australis**

LIST OF SPECIES

- montanus** Jacobi, Sjost. Zool. Kil-Meru Exped. II, 1905-6, Hom. p. 120 (1910). Usambara, Nguelo, Kilimanjaro, Kibonoto, Meru, E. Africa.
thelwalli Distant, Ann. Mag. N. H. xviii, p. 24 (1916). Nyasaland.
altifrons Walker, List Hom. B. M. p. 608 (1851). Congo, Cameroons, Lagos, W. Africa; Uganda, Ruwenzori, Kafu R., Hoima, Kampala Road, Amani, Sagital, E. Africa.
atratus Walker, List Hom. B. M. p. 624 (1851). Sierra Leone.
bos Signoret, Thoms. Arch. Ent. ii, p. 336 (1858). Calabar, Gabon, Congo.
gnomen Buckton, Mon. Memb. p. 251, pl. 57, fig. 4. Old Calabar, Cameroons.
lama Signoret, Thoms. Arch. Ent. ii, p. 338 (1958). Calabar, Cameroons.
areomaculatus Distant, Ann. Mag. N. H. xvii, p. 315 (1916). Uganda, Kafu R., Unyoro, Kampala Road, Ankole-Toro Border.
limbipennis Jacobi, Wiss. Erg. Deut. Cent. Afric. Exped. 1907-8, p. 34, pl. 3, fig. 12 (1912). Ruwenzori, Kwidjwi, E. Africa.
grossus Distant, Ann. Mag. N. H. xvii, p. 315 (1916). Uganda, Entebbe Forest, Buamba Forest, Semliki Valley, Takalu, E. Africa.
arebiensis Goding, new species, (in this paper, *supra*). Arebi, Dungu, N-W Congo.
ugandensis Distant, Ann. ag. N. H. xvii, p. 151 (1916). Uganda, Entebbe Forest, Toro, Mbarara, Lake George, Arebi, Takalu, E. Africa.
rufipennis Buckton, Trans. Linn. Soc. Lond. Zool. ix, p. 334, pl. 22, fig. 8 (1905). Cameroons.
peracatus Distant, Ann. Mag. N. H. xvii, p. 151 (1916). Somaliland, N-E Africa.
confusus Distant, Ann. Mag. N. H. xvii, p. 151 (1916). Cameroons; Kenya, Meru-Nyeri. Road, Aberdare Mts., E. Africa.
leucaspis Melichar, Wein. Ent. Zeit. xxiv, p. 295 (1905). Amani, E. Africa.
montana Jacobi, (variety), Sjost. Zool. Kil-Meru Exped. II, 1905-6. Hom. p. 120, pl. 2, fig. 2 (1910). Usambara, Nguelo, Kilimanjaro, Meru, Kibonoto, Kiboscho, E. Africa.
australis Distant, Ann. Mag. N. H. xviii, p. 24 (1916). Malvern, Natal.

Dacaratha

- Distant, Ann. Mag. N. H. xvii, p. 319 (1916).

KEY TO SPECIES

One black species, tibiae and tarsi castaneous; suprahumeral short, obliquely angulate directed backward; posterior process convexly elevated above the scutellum, straight, touching the tegmina, which are subhyaline, base black, outwardly margined with ochraceous, apical area testaceous; 7 mm. **nyasana**

LIST OF SPECIES

nyasana Distant, Ann. Mag. N. H. xvii, p. 319 (1916). Lake Nyassa, East Africa.

Tshaka

Distant, Ins. Transv. i, p. 214, pl. 22, fig. 3 (1908).

KEY TO SPECIES

- 1(4). Suprahumeral short, transverse, robust, straight, tips slightly recurved; posterior process undulate; pronotum black, tegmina yellowish, base, spot on costa and one behind clavus, piceous, tarsi pale.
- 2(3). Apical veins of tegmina granulose; 6.5 x 3.5 mm. **naturalis**
- 3(2). Apical veins of tegmina smooth; 5 x 4 mm. **undulatus**
- 4(1). Suprahumeral long, transverse, strongly curved; pronotum black, tegmina as in (4), tarsi yellow; 4.5-5 x 2-3.5 mm. **obortus**

LIST OF SPECIES

naturalis Distant, Ins. Transv. i, p. 214, pl. 22, fig. 4 (1908). Lydenburg, Transvaal.

undulatus Distant, Ann. Mag. N. H. xvii, p. 324 (1916). Salisbury, Mashonaland.

obortus Distant, Ann. Mag. N. H. xviii, p. 42 (1916). Pretoria, Transvaal.

Otinotus

Buckton, Mon. Memb. p. 232 (1903).

KEY TO SPECIES

- 1(8). Suprahumeral short, robust, broad, prismatic, slightly oblique, acuminate, tips lightly recurved.
- 2(7). Posterior process slender, weakly sinuate; pronotum brown or black, tomentose or pilose.
- 3(4). Length 7 mm.; suprahumeral oblique, front margin strongly curved, hind margin straight; posterior process distinctly undulating; tegmina brown, veins hairy; tarsi yellow **griseus**
- 4(3). Length 8 to 10 mm.; posterior process weakly sinuate.
- 5(6). Posterior process impinging upon scutellum and tegmina, tip black; front margin of suprahumeral curved, hind margin straight; tegmina hyaline, apical angle acute; pronotum brown; 9 mm. **pilosus**

- 6(5). Posterior process elevated above scutellum and tegmina; suprahumeral distinctly recurved; pronotum black, tegmina brown, broad transverse ochraceous fascia near base; 10 mm. **recurvus**
- 7(2). Posterior process heavy, strongly arcuate, base slightly elevated above the scutellum, apical half impinging upon the tegmina, the latter hyaline; ferruginous-brown; 8 mm. **arcuatus**
- 8(1). Suprahumeral slender; pronotum black.
- 9(10). Suprahumeral horizontal, slightly elevated, with a central carina; posterior process slightly elevated above scutellum, then impinging upon the tegmina which are pale brown and obscure ochraceous transverse fascia; 8-9 mm. **nigrorufus**
- 10(9). Suprahumeral weakly oblique, strongly recurved; apical area of posterior process impinging upon the tegmina which are as in 9(10); 8-9 mm. **curvidens**

LIST OF SPECIES

- griseus** Melichar, Wien, Ent. Zet. xxiv, p. 295 (1905). Bomole, Amani, E. Africa.
- pilosus** Funkhouser, Can. Ent. li, p. 222, pl. 19, figs. 5-6 (1919). German East Africa.
- recurvus** Distant, Ann. Mag. N. H. xvii, p. 154 (1916). Entebbe, Lake Isolt, Wamala, Uganda.
- arcuatus** Funkhouser, Can. Ent. li, p. 222, pl. 19, figs. 7-8 (1919). Pretoria, Transvaal.
- nigrorufus** Distant, Ann. Mag. N. H. xvii, p. 153 (1916). Masinde, Uganda; Eastern Mbale, Elgon; Mpanga Forest, Toro; Mabiri Forest, Chagwe; Kafu R., Hoima; Kampala Road, Jinja and Busia, East Busoga; Entebbe, East Africa.
- curvidens** Distant, Ann. Mag. N. H. xvii, p. 154 (1916). Cameroons; Entebbe, Lake Isolt, Wamala, East Africa.

Centruchus

- Stål, Hemip. Afric. iv, p. 93 (1866); *Leucothorax* Buckton, Trans. Linn. Soc. Lond. ix, Zool. p. 334 (1905).

KEY TO SPECIES

- 1(2). Suprahumeral short, stout, triquetrous, horizontal, tips acute; pronotum ferruginous to black, slightly pubescent beneath; median carina weak; tegmina fusco-hyaline; legs ferruginous; 10 mm. **capensis**
- 2(1). Suprahumeral longer, prismatic, horizontal, tips truncate; sides of chest densely pubescent; median carina strong; tips of tibiae and tarsi yellow.
- 3(4). Black; upper surface of suprahumeral with a carina near hind margin; scutellum smooth, apex yellow; tegmina lightly infusate; 8 mm. **fuscipennis**

- 4(3). Dark shining brown, sides of chest with broad shaggy pubescence, basal angles of scutellum pubescent; tegmina fuscous, shining; 12 mm. **villosus**

LIST OF SPECIES

- capensis** Germar, Rev. Ent. Silb. iii, p. 256 (1835). Cape of Good Hope.
fuscipennis Germar, Rev. Ent. Silb. iii, p. 256 (1835). Cape Colony, Caffraria. Bomole, East Africa; Albert-Sea, Undussuma, Congo Free State.
pacificus Gerstæcker, Deck. Reis. Ost-Afrik. ii, p. 430 (1873). Mombas, East Africa.
villosus Buckton, Trans. Linn. Soc. Lond. ix, p. 334, pl. 22, fig. 5 (1905). Cameroons.

*Hypsauchenini***Congellana**

- Distant, Ins. Transvaal, i, p. 213 (1908).

KEY TO SPECIES

- 1(4). Basal angle of posterior process with an anterior tooth; tarsi yellow.
 2(3). Tegmina black; pronotum, body and legs black, pubescent; 9-10 mm. **electa**
 3(2). Tegmina shining yellow, apical margin, interior half of corium, and spot on costa, fuscous; pronotum dark-brown, an oblique white line from hind margin extends on front process; tibiae yellow; 9 mm. **strigata**
 4(1). Basal angle of posterior process without a tooth, (the horizontal part of the posterior process wanting in the type); castaneous, legs paler; tegmina brownish-ochraceous, tip of costal darker, pale spot on inner margin; 7 mm. **leighi**

LIST OF SPECIES

- electa** Melichar, Wein. Ent. Zeit. xxiv, p. 296 (1905). Amani, Usambara, Lake Victoria Nyanza, Kwankorro, East Africa.
strigata Buckton, Trans. Linn. Soc. Lond. ix, p. 333, pl. 22, fig. 3 (1905). Cameroons.
leighi Distant, Ins. Transv. i, p. 213, pl. 21, fig. 21 (1908). Congellana, Durban, Natal.

*Centrochaesini***Negus**

- Jacobi, Sjost. Zool. Kil-Meru Exped. II, 1905-6, Hom. p. 121 (1910).

KEY TO SPECIES

- One black species covered with bristle-bearing nodules; suprahumeral short, broad, oblique, compressed, almost foliaceous, tips truncate, slightly

broader than bases; posterior process triquetrous, with a basal and subapical node, slightly separated from the scutellum and impinging upon margins of tegmina, rather narrow; tegmina smoky-hyaline, base and spot on costa black, veins yellow, covered with hairy nodules; 6 mm. **asper**

LIST OF SPECIES

asper Jacobi, Sjost. Zool. Kil-Meru Exped. II, 1905-6, Hom. p. 121, pl. 2, fig. 9 (1910). Kilimanjaro, Kibonoto, East Africa.

MEMBRACINÆ

*Xiphistesini***Xiphistoides**

Goding, Ann. Ent. Soc. Am. xxiv, p. 936, (1931); *xiphidia* Goding, Jour. N. Y. Ent. Soc. xxxviii, p. 92 (1930).

KEY TO SPECIES

- 1(2) Pronotum tumid, fuscous marked with black, a small tubercle above each humeral; posterior process slender, apical area compressed a keeled appendage beneath not serrate; tegmina hyaline, costa fuscous; 5 mm. **inermis**
- 2(1). Pronotum convex, brown, base slightly projecting, a short carina above each humeral, dorsal line straight; posterior process slender, straight, apex obtuse, not keeled beneath; tegmina hyaline, base yellowish, veins with brown nodules; 7 mm. **carinata**

LIST OF SPECIES

inermis Jacobi, Sjost. Zool. Kil-Meru Exped. II, 1905-6, Hom. p. 119, pl. 2, fig. 7 (1910). Kilimanjaro, Kibonoto, East Africa.

carinata Funkhouser, An. Mus. Acad. Sci. USSR, xxviii, p. 147, pl. 5, fig. 3 (1927). Buddu Forest, Itara, Victoria Nyanza.

Gongroneura

Jacobi, Sjost. Zool. Kil-Meru Exped. II, 1905-6, Hom. p. 120 (1910); *Pedalion* Buckton, Mon. Memb. p. 251 (1903).

KEY TO SPECIES

- 1(4). Veins of tegmina distinctly nodulate.
- 2(3). Suprahumeral very short, horizontal, tips obtuse and not elevated above disk of pronotum; yellow brown, disk of pronotum, sides and apex posterior process, body and legs blackish; tegmina hyaline, base, nodes on veins, and spot near apex clavus black; 6-7 mm. **brevicornis**
- 3(2). Suprahumeral about as long as the intermediate space, oblique, tips truncate and distinctly higher than disk of pronotum; ferruginous brown; tegmina hyaline; apex of the posterior process briefly elevated; 7 mm. **confusa**

- 4(1). Veins of tegmina destitute of nodules.
 5(8). Posterior process nearly long as tegmina; suprahumeral oblique, tips seen from the front truncate; brown.
 6(7). Tegmina brown and ochreous mottled; 5-6 x 3-5 mm. **triste**
 7(6). Tegmina hyaline, veins curved and yellow with brown punctures; 6 x 3 mm. **ornata**
 8(5). Posterior process distinctly shorter than tegmina; suprahumeral variable in length, seen from the front briefly acute, seen from the side truncate; ochreous, dorsal nodes and apex posterior process blackish; tegmina hyaline, one or two indistinct transverse fasciæ and costal dots brown; 7-8 x 4 mm. **delalandei**

LIST OF SPECIES

- brevicornis** Jacobi, Sjost. Zool. Kil-Meru Exped. II, 1905-6, Hom. p. 120, pl. 2, fig. 3 (1910). Kilimanjaro, Kibonoto, E. Africa.
confusa Distant, Ann. Mag. N. H. xviii, p. 23 (1916). Pretoria, Transvaal, Natal, Cape Colony, S. Africa.
delalandei Jacobi, Sjost. Zool. Kil-Meru Exped. II, 1905-6, Hom. p. 119, pl. 2, fig. 1, 10 (1910). Mombo, Usambara, E. Africa.
triste Buckton, Mon. Memb. p. 252, pl. 57, fig. 5 (1903). Cameroons, W. Africa.
delalandei Buckton, Mon. Memb. p. 252, pl. 57, fig. 7 (1903); Distant, Ins. Transvaal, i, p. 212, pl. 21, fig. 15 (1908). Natal, Cape Colony, Pretoria, Transvaal; Mashonaland, S. Africa.
fasciatum Buckton, Mon. Memb. p. 253, pl. 60, fig. 8 (1903). Cape Colony, Mashonaland, S. Africa.
punctipennis Buckton, Mon. Memb. p. 253, pl. 57, fig. 8 (1903). Cape Colony.

Xiphistes

- Stål, Hemip. Afric. iv, p. 85 (1866); *Neoxiphistes* Distant, Trans. Ent. Soc. Lond. (3), iii, p. 515 (1914).

KEY TO SPECIES

- 1(10). Apex of posterior process subreaching or passing tips of tegmina.
 2(7). Suprahumeral long, porrect or strongly inclined forward; pubescent.
 3(4). Suprahumeral parallel, medium slender, slightly approaching, tips acute outwardly; posterior process concavely sinuate, apical area elevated dentate beneath; brown, tegmina hyaline; 5 mm. **longicornis**
 4(3). Suprahumeral broad, slightly diverging; posterior process subequal to tegmina in length, the latter sordid hyaline.
 5(6). Posterior process concavely sinuate, apical area elevated, serrate beneath; black; 8-9 mm. **vetusta**
 6(5). Posterior process straight, apical area decurved, not serrate beneath; ferruginous, head black, a denticle beneath each eye; 7-8 mm. **sulcicornis**

- 7(2). Suprahumeral long, oblique or subhorizontal; tegmina hyaline.
- 8(9). Posterior process much longer than the tegmina, apical half brown; suprahumeral robust, oblique, long as width of pronotum, tips brown; piceous, median carina brown; 8-10. **lagoensis**
- 9(8). Posterior process slender, long as tegmina; suprahumeral long as pronotum behind them, slender, subhorizontal, tips depressed; posterior process slender, long as tegmina, apex depressed; form elongate, pale brownish-ochraceous; 7.5 mm. **attenuata**
- 10(1). Posterior distinctly shorter than the tegmina.
- 11(18). Suprahumeral very short, not longer than half the width of pronotum.
- 12(13). Suprahumeral moderately inclined forward, oblique, tips obtuse; brownish-testaceous, tegmina subhyaline; 7.5-8 mm. **concolor**
- 13(12). Suprahumeral oblique or transverse, not inclined forward.
- 14(15). Suprahumeral reduced to two strong obtuse tubercles directed upward; brownish-ochraceous, tegmina vinaceous hyaline; 7 mm. **tuberculatus**
- 15(14). Suprahumeral distinctly produced, acuminate; pubescent.
- 16(17). Fuscous-black; slightly obliquely elevated; tegmina subhyaline; 7 mm. **furcicornis**
- 17(16). Dull, ochraceous; suprahumeral subhorizontal; tegmina narrowly opaque, base and veins (not apical veins) granulose; 5.5 mm. **exigua**
- 18(11). Suprahumeral at least longer than width of the pronotum.
- 19(24). Suprahumeral moderately inclined forward.
- 20(23). Suprahumeral slightly diverging, robust, tips acute; tegmina lurid; pubescent.
- 21(22). Suprahumeral twice longer than width between bases, strongly compressed, very broad; pronotum ferruginous, low in front; tegmina ferruginous at base with whitish band; 9 mm. **dilaticornis**
- 22(21). Suprahumeral thrice longer than width between bases, prismatic, conical; pronotum piceous, rather high in front; posterior process lightly curved upward; tegmina tawny at base; 6 mm. **suberecta**
- 23(20). Suprahumeral moderately slender, subhorizontal, tips truncate; posterior process sinuous, free above abdomen; black, pubescent, tegmina smoky-hyaline; 8 mm. **tanganensis**
- 24(19). Suprahumeral very robust, transversely oblique, tips truncate; posterior process slender, rugulose, serrate beneath, apex recurved; fuscous-brown, tegmina subhyaline, brown spot near apex of clavus; 8.5 mm. **crassicornis**

LIST OF SPECIES

- longicornis** Distant, Ins. Transv. i, p. 212, pl. 21, fig. 20 (1908). Melsetter, Gazaland, Rhodesia.
- vetusta** Walker, List Hom. B. M. p. 507 (1851). Natal.

- latipes* Buckton, Mon. Memb. p. 253, pl. 58, fig 1 (1903). Natal.
- sulcicornis* Thunberg, Hemip. Rostr. cap. i, p. 2 (1822). Cape Colony, Caffraria, Pretoria, Transvaal, Delagoa Bay, Umtali, Rhodesia, Melsetta, Gazaland.
- parallela* Walker, List Hom. B. M. p. 508 (1851). Natal.
- decisus* Buckton, Mon. Memb. p. 226, pl. 50, fig. 1 (1903). Delagoa Bay.
- pallidus* Buckton, Mon. Memb. p. 227, pl. 50, fig. 5 (1903). Unknown.
- lagoensis* Distant, Trans. Ent. Soc. Lond. (3), iii, p. 515 (1914). Oni Lagos, N. Nigeria.
- attenuata* Distant, Ann. Mag. N. H. xvi, p. 324 (1915). Lesapi R., Mashonaland.
- concolor* Buckton, Mon. Memb. p. 224, pl. 49, fig. 4 (1903); Distant, Ins. Transv. i, p. 210, pl. 22, fig. 1 (1908). Pretoria, Transvaal, Cape Colony, Umtali, Rhodesia.
- crassus* Distant, Ann; Mag. N. H. xvii, p. 313 (1916). Salisbury, Mashonaland.
- tuberculatus* Walker, Ins. Saund. Hom. p. 109 (1858); Distant, Ins. Transv. 1, p. 210, pl. 21, fig. 14 (1908). Cape Colony, Pretoria, Transvaal, Umfuli R., Mashonaland, Umtali, Rhodesia.
- furcicornis* Germar, Rev. Ent. Silb. iii, p. 232 (1835); Distant, Ins. Transv. 1, p. 210, pl. 21, fig. 12 (1908). Cape Colony, Pretoria, Transvaal, Umfuli R., Mashonaland.
- tarandus* Buckton, Mon. Memb. p. 233, 49, fig. 3 (1903). Cape Colony.
- nodosus* Buckton, Mon. Memb. p. 226, pl. 50, fig. 4 (1903). Grahams-town, Cape Colony.
- exigua* Buckton, Mon. Memb. p. 232, pl. 52, fig. 5 (1903); Distant, Ins. Transv. 1, p. 211, pl. 22, fig. 3 (1908). Natal.

Oxyrhachisini

There has been recognized but one genus in this tribe from Africa.

Oxyrhachis

Germar, Rev. Ent. Silb. iii, p. 232 (1835); *Polocentrus* Buckton, Mon. Memb. p. 253 (1903); *Ouranorthis* Buckton, Trans. Linn. Soc. Lond. ix, p. 333 (1905).

KEY TO SPECIES

- 1(10). Posterior process longer than tegmina, apex elevated.
- 2(5). Suprahumerals subhorizontal; tegmina dull hyaline.
- 3(4). Inferior margin of posterior process serrate, apical area compressed; ferruginous or fuscous, base of tegmina narrowly pale ferruginous; 7-8 mm. **tarandus**
- 4(3). Inferior margin of posterior process smooth, not serrate, base ochraceous, apical half blackish, attenuated; piceous brown, carinae paler, base and costal margin of tegmina and spot behind clavus piceous; 6 mm. **lamborni**

- 5(2). Suprahumeral strongly oblique or nearly erect; inferior margin of posterior process more or less distinctly serrate.
- 6(9). Suprahumeral directed upward, nearly erect.
- 7(8). Brown, pilose; tips of suprahumeral acute; apical area of posterior process blackish, median carina pale; tegmina hyaline, black spot behind clavus; 6-7 mm. **bisenta**
- 8(7). Yellow; tips of suprahumeral truncate; apical area of posterior process compressed; tegmina vinaceous hyaline; 8 mm. **caudatus**
- 9(6). Suprahumeral oblique, margins and apical areas testaceous, tips acute, piceous; median carina and legs testaceous; tegmina hyaline, base blackish; 8 mm. **pandatus**
- 10(1). Posterior process not longer than the tegmina.
- 11(24). Apex of posterior process reaching tips of the tegmina.
- 12(17). Inferior margin of the posterior process serrate.
- 13(16). Suprahumeral subhorizontal; apical area of posterior process elevated.
- 14(15). Ferruginous-brown; suprahumeral short, thick, tips truncate, carinae and tips paler; posterior process with a blackish gibba at middle; tegmina vitreous, base yellow, black spot behind the clavus; 7 mm. **delalandei**
- 15(14). Piceous, pubescent, pronotum partly ferruginous; suprahumeral very broad, acute; posterior process lightly bisinuate, apical area compressed, black; tegmina lurid, basal half of costa black, apical half ferruginous; 8 mm. **suberratus**
- 16(13). Suprahumeral short, almost erect, slightly diverging, tips acute; posterior process substraight, apical area compressed; ferruginous or fuscous, tegmina vitreous; 7 mm. **gambiae**
- 17(12). Inferior margin of posterior process not serrate; suprahumeral subhorizontal.
- 18(19). Base of posterior process with a gibba, apical area compressed; piceous, not pubescent, median carina reddish spreading around the gibba; base of tegmina black, costa reddish, black spot behind clavus; tibiae yellow, tarsi brown; 10 mm. **gibbulus**
- 19(18). Base of posterior process not gibbous.
- 20(23). Black, pubescent, with reddish markings; posterior process almost horizontal, apical area not compressed; tegmina subhyaline.
- 21(22). Basal half of posterior process sanguineous, legs black; tips of the robust broad suprahumeral obtusely angulate; 7 mm. **egyptianus**
- 22(21). Posterior process concolorous, slightly tapering to apex; suprahumeral short, thick, tips acute; 6-7 mm. **tenebrosus**
- 23(20). Pale testaceous Metopidium, apical half of posterior process, two fasciae on pronotal disk, and face, black; suprahumeral short, broad acute; posterior process lightly concave; tegmina hyaline, black spot behind clavus; 5 mm. **nigropictus**

- 24(11). Apex of posterior process not reaching tips of tegmina, elevated, compressed, inferior margin serrate; suprahumeral very short, subhorizontal, acute; orange-yellow fuscous mottled, metopidium brown; cells of tegmina yellow, veins brown; 8 mm. **labatus**

LIST OF SPECIES

- tarandus** Fabricius, Ent. Syst. Suppl. p. 514 (1796); Fairmaire, Rev. Memb. p. 268, pl. 4, fig. 8 (1846); Distant, Faun. Brit. Ind. iv, p. 4, fig. 1 (1907); Distant, Ins. Transv. i, p. 209, pl. 21, fig. 11 (1908). Eastcourt, Durban, Natal, Waterburg, Transvaal; Senegal; Egypt; Abyssinia; Kibotini, East Africa; East Indies.
- rufus** Buckton, Mon. Memb. p. 254, pl. 56, fig. 2 (1903). Mysore, India.
- neuter** Buckton, Mon. Memb. p. 254, pl. 58, fig. 3 (1903). Madras, India.
- lamborni** Distant, Ann. Mag. N. H. xviii, p. 19 (1916). South Nigeria.
- bisenta** Distant, Ann. Mag. N. H. xvi, p. 233 (1915). Durban, Natal, Salisbury, Rhodesia, Nlange, Nyasaland.
- caudatus** Buckton, Trans. Linn. Soc. Lond. ix, p. 335, pl. 22, fig. 9 (1905). Natal.
- pandatus** Distant, Ann. Mag. N. H. xviii, p. 20 (1916). Cameroons.
- delalandei** Fairmaire, Rev. Memb. p. 268 (1846). Mariut, Oasis Fajum, Egypt; Tunis; Jordan R., Syria, Sicily; (Natal, Cape, doubtful).
- subserratus** Walker, List Hom. B. M. p. 506 (1851). Belgium Congo, Angola.
- gambiæ** Fairmaire, Rev. Memb. p. 269 (1845). Senegal, Calabar.
- fastidiosa** Signoret, Thoms. Archiv. Ent. ii, p. 335 (1858). Calabar.
- gibbulus** Melichar, Wein. Ent. Zeit. xxiv, p. 294 (1905). Tanga, Kilimanjaro, Kibonoto, Usambara, Mombo, Ituri. East Africa; Cairo, Hilwan, Heliopolis, Egypt.
- egyptianus** Distant, Ann. Mag. N. H. xvi, p. 332 (1915). N. Ethai, Upper Egypt.
- tenebrosus** Walker, List Hom. B. M. p. 623 (1851). Sierra Leone.
- nigropictus** Distant, Ann. Mag. N. H. xviii, p. 20 (1916). Upper Nzoia R., East Africa.
- labatus** Buckton, Trans. Linn. Soc. Lond. ix, p. 335, pl. 22, fig. 10 (1903).

PLATE II (after Jacobi)

Figure 12. *Leptocentrus limbipennis* Jacobi.

Figure 13. *Centrotus subnodosus* Jacobi.

Figures 14 and 14a. *Paraxiphopoeus schubotzi* Jacobi.

a. *Spalirises alticornis* Jacobi.

b, c. *Spalirises humilis* Goding.

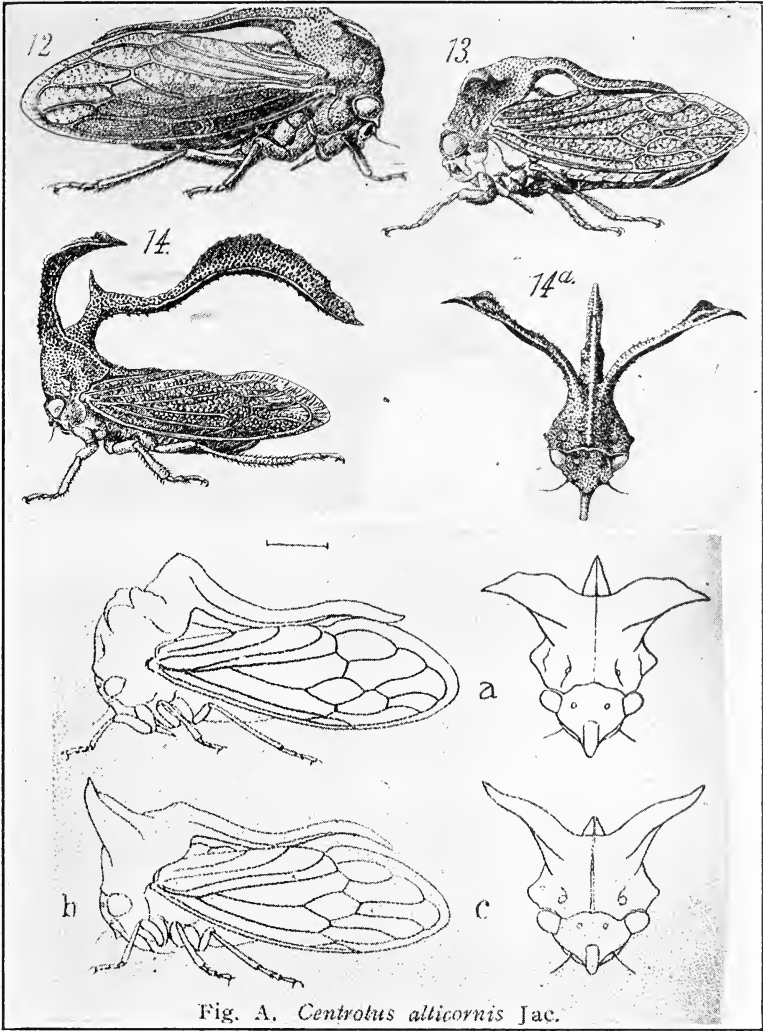


Fig. A. *Centrotus alticornis* Jac.

MEMBRACIDÆ

PLATE III (after Jacobi)

Figures 1 and 10. *Gongroneura pictipennis* Buckton.

Figure 2. *Leptocentrus montanus* Jacobi.

Figure 2a. *Leptocentrus confusus* Distant.

Figures 3 and 3a. *Gongroneura brevipennis* Jacobi.

Figures 4 and 4a. *Anchon dschagga* Jacobi.

Figures 5 and 5a. *Planecornua infracta* Jacobi.

Figures 6, 6a, 6b. *Anchon aries* Jacobi.

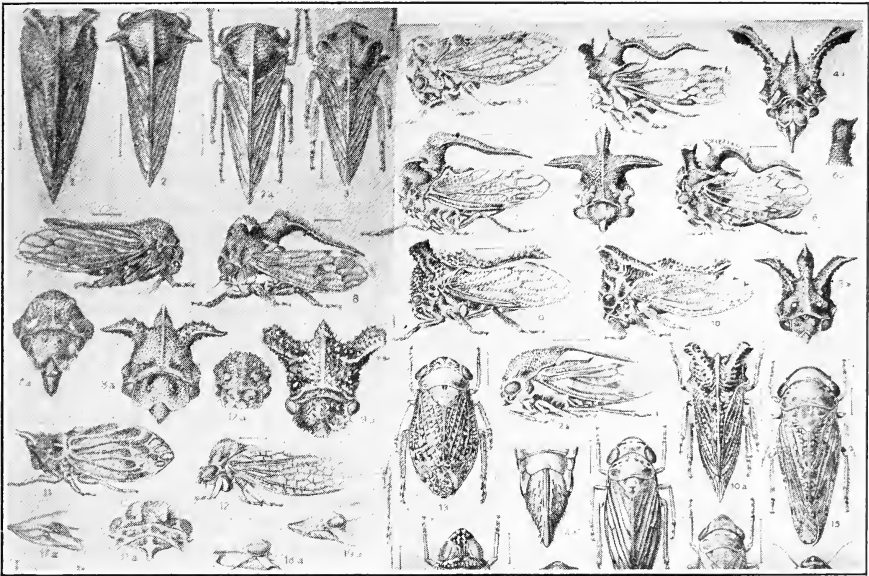
Figures 7 and 7a. *Xiphistoides inermis* Jacobi.

Figures 8 and 8a. *Euxiphopocus hirculus* Jacobi.

Figures 9 and 9a. *Negus asper* Jacobi.

Figures 12 and 12a. *Coloborrhis perspicillaris* Gerstæcker.

The others are not membracids.

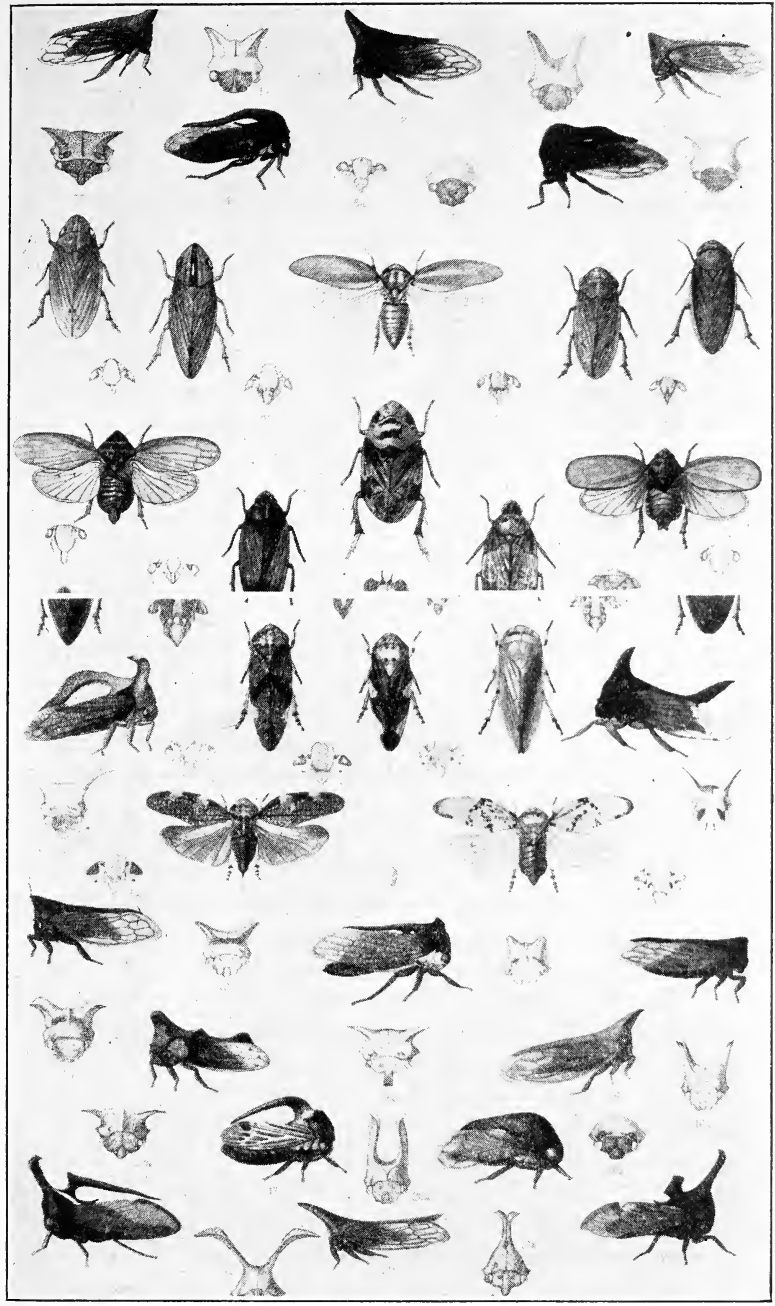


MEMBRACIDÆ

PLATE IV (after Distant)

- Figures 1 and 1a. *Xiphistes concolor* Buckton.
Figures 2 and 2a. *Xiphistes suberecta* Walker.
Figures 3 and 3a. *Xiphistes exigua* Buckton.
Figures 4 and 4a. *Tshaka naturalis* Distant.
Figures 5 and 5a. *Kombazana fidelis* Distant.
Figures 10 and 10a. *Xiphopocus horridulus* Walker.
Figures 11 and 11a. *Oxyrhachis tarandus* Fabricius.
Figures 12 and 12a. *Xiphistes furcicornis* Germar.
Figures 13 and 13a. *Centrotus bantuantus* Distant.
Figures 14 and 14a. *Xiphistes tuberculatus* Walker.
Figures 15 and 15a. *Gongroneura delalandei* Buckton.
Figures 16 and 16a. *Xiphistes sulcicornis* Thunberg.
Figures 17 and 17a. *Tricoesepe pubipennis* Fairmaire.
Figures 18 and 18a. *Gargara makalakæ* Distant.
Figures 19 and 19a. *Anchon nodicornis* Germar.
Figures 20 and 20a. *Xiphistes longicornis* Distant.
Figures 21 and 21a. *Congellana leighi* Distant.

The others are not membracids.



MEMBRACIDÆ

ADDITIONAL RECORDS OF NORTH AMERICAN CICADAS WITH DESCRIPTIONS OF NEW SPECIES

BY WM. T. DAVIS
STATEN ISLAND, N. Y.

During the past few years several thousand cicadas from North America have been examined with the result that a number of species originally described from a few specimens are now much better known, and their distribution considerably extended. The present paper has been prepared with the idea of recording these facts, and the writer has also added some of the observations of others, kindly sent to him at the time the specimens were transmitted. Dr. Raymond H. Beamer and his associates from Kansas State University have succeeded in collecting a surprising number of species in their annual biological field trips. The notes and observations of the trip of 1929 were recorded by L. D. and R. H. Beamer in this JOURNAL for September, 1930, and make interesting reading to a student of the group.

While the species of cicadas known from the United States and Canada have been noticed in the several papers published in this JOURNAL, thus making the information easily accessible, there is need for an annotated list, and it is hoped that one can be prepared in the near future. It is likely, however, that there are a number of other species to record, and the considerable periods that certainly elapse between the appearance of the broods of the species occurring in any given locality, will prevent, for a long time, the making of a reliable list for even a single state.

Two new species and several varieties are described in the present paper, but it is likely that with more collecting the new forms of *Platypedia* mentioned, will in time, be regarded as species.

I am indebted to Mr. Everett C. Lerch, of the Staten Island Institute of Arts and Sciences, for all but two of the photographs included in the plates.

***Tibicen robinsoniana* Davis.**

The distribution and habits of this species are recorded in this JOURNAL, March, 1922, p. 41; 1923, p. 7; 1925, p. 38; 1926, p. 177, and 1930, p. 58. It was known from Virginia, Missouri and Tennessee. In 1930 Dr. R. H. Beamer and his companions extended the range to Mississippi and Alabama. Ten males were collected at Shuqualak, Noxubee County, Miss., on July 16, and also on July 16 Mr. Paul W. Oman collected a male and female at Gallion, Hale County, Alabama.

Dr. Beamer likened the song to one of the notes of a scolding blue jay, and noted the considerable resemblance in appearance to *Tibicen pruinosus*, but the song "entirely different." He heard them singing in numerous places as he and his party drove southward in Mississippi, and records that the majority were found in cedar trees and collected by shooting. At Shuqualak they were in oaks and cedars. In Alabama they were heard singing at Coatopa, and at Gallion they were on a dry hill sparsely set with small cedars.

***Tibicen cultriformis* Davis.**

This species was described in this JOURNAL for December, 1915, and up to the end of 1929 eleven specimens had been examined, all from Arizona and particularly from the southeastern part of the state along branches of the Gila River, or from Santa Cruz County.

Prof. E. D. Ball has recently sent me specimens from Payson, Gila County, Arizona, collected August 3, 1929, and Patagonia, Santa Cruz County, collected September 20, 1930, with the following report on the insect: "We moved into camp up on the east branch of the Verde, and in the afternoon there was not a single Cicada singing in the region. That night it rained and before morning the ladies in the tents were troubled with "bed-bugs"; very large sized ones which set them shrieking. In the morning I found about 50 pupae climbing up the trees in a little area about 10 rods long and 2 wide. From these I succeeded in hatching 10 or 15 specimens but owing to the wet weather most of these moulded. I took the rest of the pupae with me up to Long Valley to the next camp site and put them out in the shrub-

bery, but they had been in the paper box so long that they had dried up apparently too much to come out, and they fell off of the trees and were eaten by the chickens. Since then I have found this species in enormous numbers on the Santa Cruz river bottoms from Nogales up about 40 miles toward Tucson, but apparently it does not come any farther up in this area. They are found there on the cottonwoods and big black willows. I happened to get in there just as they appeared and was able to get quite a set. I was down there the last week in October this year [1931] and they were still howling vociferously in the trees."

Mr. D. K. Duncan found this large cicada very common but hard to locate high up in ash and sycamore trees along Hegler Creek, 10 miles north of Young, Gila County, Arizona, on September 1 to 4, 1930. He describes the song as an extremely shrill, intermittent chirp. They broke out once in a while when the sun was very hot and chirped for only a few minutes at a time, then kept quiet for an hour or so. About dusk they shrilled the loudest. But three were captured. Mr. Duncan further states that in passing through Pleasant Valley he stopped at Young, Arizona, for dinner. "While there a black cat ran up a sycamore tree and captured another of these cicadas. After chasing the cat I took it away from it undamaged. The lady said the cat made a habit of watching for them and when seeing one light in the top of a tree, would run up the tree and catch it. She said he caught some every day and would bring them down and play with them like a mouse. This sounds fishy, but nevertheless it is a fact. I asked her to take them away from the cat if possible and save them for me, and she said she would, but cannot depend upon it of course as she has other things to do besides taking away cicadas from the cat. Guess I should have bought the cat to catch them for me."

In 1931 Mr. Duncan reported that there were no *cultriformis* singing along Hegler Creek on June 15, but that they were very common and out of reach on September 1 and 2. They were also very common in Pleasant Valley. They were in sycamore, cottonwood, ash and walnut trees with no special taste for any particular kind.

***Tibicen tigrina* Davis.**

In Landa Park, New Braunfels, Texas, July 14, 1931, my companions, Mr. E. V. Walter and Mr. Engelhardt, located a *Tibicen tigrina* by its song in a rather small tree, and succeeded in capturing it for me. The song is like that of *Tibicen inauditus* but louder. It is an even buzzing or *zing*, and may continue for some time. There were a number of *tigrina* about, but we could collect but the one male.

This species was described in this JOURNAL, December, 1927, from specimens collected by Otto M. Locke, Jr. It was formerly considered to be *Tibicen montezuma* Distant, but incorrectly, for we now have the true *montezuma* from Mexico. Of *tigrina* collected July, 1925, in the Arbuckle Mts., Oklahoma, Dr. Raymond H. Beamer wrote: "This species was taken over an area possibly ten to fifteen miles in extent, in cedars and oak. Its song was shrill and long continued while undisturbed. I found them exceedingly hard to locate, and some of them quite wild. As I remember its song very much resembled that of *Tibicen bifidus*." (See this JOURNAL, June, 1926, p. 178.)

***Tibicen inauditus* Davis.**

We first heard *inauditus* in the Davis Mountains, Texas, at Tippet's Ranch. The song is a continuous low *zing*, and the insect is often much nearer than its song would seem to indicate. On June 29, 1931, we collected a male and female. The next day on the low oaks well up on Mitre Peak, the top of which we reached, we collected 9 males and 2 females. The insects relied for protection on their close resemblance to the bark of the oaks on which they rested. When discovered they usually could be picked off of the trees with one's fingers. Some Mexican boys collected 17 males and 1 female, and two young men, who were staying at Tippet's Ranch for a few days, collected 33 males and 15 females. Later in Chisos Mountains, on July 5, I collected 3 males and 1 female, also on oaks. Thus 83 specimens were secured of what has been a rather rare cicada in my collection.

I was much surprised to find that the songs of both *inauditus* and *tigrina* were continuous, that is lasting for a long time, in this respect differing markedly from the *Tibicens* of the eastern states in which the song is but of short duration.

Diceroprocta biconica Walker and **Diceroprocta bonhotei** Distant.

In *D. biconica* Walker, 1850, described from Cuba, the terminal dorsal spine of the last abdominal segment of the female usually does not bend upward to any great extent; the terminal part of the abdomen (sometimes the last three or four segments), is pruinose, while the area between the tympana is usually not conspicuously pruinose. Cuban specimens are as a rule lighter in color than those from Florida, and also than *bonhotei*.

In *Diceroprocta bonhotei* Distant, 1901, from the Bahamas, the terminal dorsal spine of the last abdominal segment of the female is usually bent upward, the area between the tympana is often conspicuously pruinose, and the terminal segments in both male and female are less pruinose than in *biconica*.

In the *Diceroprocta* from the Florida coast that have so far been examined there is much variation. A number of specimens viewed together resemble those from the Bahamas more than those from Cuba in the disposition of the pruinose areas. The terminal dorsal spine of the last abdominal segment of the female may be as in *biconica*, that is, not bent upward to any great extent, or it may have a considerable upward bend.

The observations on the Florida specimens are based mainly on an examination of the 12 females and 8 males labeled Key Largo, August 9, 1930, collected by Dr. Raymond H. Beamer and his three companions from the University of Kansas. There may be two closely allied species included in this series for Dr. Beamer reports: "We noticed that when a cicada started singing all others would sing a similar song; then in a few minutes that song would cease entirely and several cicadas would be singing another song. We supposed there were two species of cicadas until we succeeded in shooting a male while he was singing the second song. His appearance was so strikingly like the one we had taken singing the other song that we decided it must all be one species." Dr. Beamer, however, enquires "Did we take both *D. biconica* and *D. bonhotei*?"

No difference has thus far been detected in the males from Florida, and in the females the slant of the terminal spine is the only character in which a difference has been observed. In one case at least the spine was intermediate.

Diceroprocta cleavesi Davis.

This species was described in this JOURNAL, March, 1930, from a single male collected on Grand Cayman Island, British West Indies, April 17, 1929. Since the receipt of the type twenty additional males and eight females have been received from Capt. T. M. Oxford, a resident of the Island. The tergum or dorsal part of the abdomen in the females is edged with white, leaving a very much broader brown area than in the males, where the sides are conspicuously pruinose and the central ovoid brown area comparatively narrow. (See Plate VIII, fig. 2, March, 1930, JOURNAL, N. Y. Ento. Soc.)

In the original description of *cleavesi* the statement is made that the dorsal spine at the tip of the abdomen in the British Museum specimen examined by Mr. W. E. China is bent slightly upward, as in *bonhotei* Distant from the Bahamas. In the eight females sent by Capt. Oxford, the spine at the tip of the abdomen is bent upward in each instance. The central notch in the last ventral segment of the female is not more deeply cut than in occasional specimens of *biconica* from Cuba.

Diceroprocta cinctifera Uhler, and variety *limpia* new variety.

On July 4, 1931, the writer collected 14 males and 23 females of *cinctifera* from the bushes along the Rio Grande and a small tributary stream, at Hot Springs, Brewster County, Texas. The females were laying eggs in numerous small branches, while many of the males were singing their songs that usually continued from 10 to 20 seconds. I had supposed from the performance of some other species of *Diceroprocta* that the song would continue for a longer time without an intermission. A male was seen clinging to the stem of a small bush, head up. It was at first supposed to be alive, but was found to have died while clinging to the bush. Ants had eaten out its abdomen and some of them were present. A cicada usually falls to the ground when it dies.

All of the specimens collected or seen at Hot Springs and later at Del Rio belonged to the typical form described by Uhler from Dona Ana County,* New Mexico. As was pointed out in this

* Dr. Beamer has recorded *cinctifera* from near Isleta on the Rio Grande, central N. M. See this JOURNAL, September, 1930, p. 294.

JOURNAL for March, 1930, this form extends down the Rio Grande to Eagle Pass or to an altitude of about 600 feet or less where the variety *viridicosta* commences, and extends down the river to the coast, a distance of about 300 miles.

On July 7, 1931, Mr. George P. Engelhardt and I were at Fort Davis, Texas, where we again heard the song of *cinctifera* in the bushes and trees bordering the stream in Limpia canyon. Here owing to the character of the vegetation the cicadas were not as easily taken as at Hot Springs where there was but one tree, a cottonwood. Six males, however, were collected and it was noticed that the opercula were generally shorter and the extremities more rounded than in *cinctifera*, or in variety *viridicosta*; also that about the inner third of each operculum was black instead of the usual pale straw-color. The dark colored central stripe on the under side of the abdomen in the males was also much broader than is usual in the typical *cinctifera*. It was evident that we had collected a new variety of *cinctifera* for which the name *limpia* is proposed. Limpia creek joins the Pecos River, which in turn is a tributary of the Rio Grande. It may well be that the ancestors of the cicadas now found in Limpia canyon made their way from the Rio Grande up the Pecos River and Limpia Creek to the Davis mountains, and that isolation has brought about the changes observed.

The measurements in millimeters of the type specimen of variety *limpia* are as follows:

Length of body 27; width of head across eyes 10; expanse of fore wings 76; greatest length of operculum 6.

From above this variety resembles *cinctifera* in having the costal margin of the fore wings orange (not greenish) to the end of the radial cell. The black dash prominent in the front part of the basal cell in var. *viridicosta*, and also present occasionally but to a less degree in typical *cinctifera*, is quite conspicuous in variety *limpia*. The pruinose areas are about the same, but the legs have more numerous black streaks and spots than in *cinctifera*.

See this JOURNAL, March, 1921, p. 2 and March, 1930.

Diceroprocta apache Davis.

This species has been recorded from Arizona, Utah, Nevada and California. Lately Mr. J. E. Davis sent me for examination

a male and five females from as far west as Newport Beach, Orange County, Calif., collected by Paul S. Sloop, Sept., 1929. It probably occurs also in western Texas, but this needs confirmation. The species, together with related forms, are considered in this JOURNAL for December, 1928, and in the JOURNAL for September, 1930, Dr. Raymond H. Beamer gives a lengthy account of its habits from observations made during the biological field trip of Kansas State University in 1929.

Mr. Engelhardt and I arrived at Indio, in the Coachella Valley, California, near evening, June 20, 1931, and found *apache* quite common on the China berry trees along the sidewalk close to Hotel Indio, and also on an orange tree in the grounds about the hotel. Five males and 3 females were collected and later some were attracted to the lights in the hotel. The song, as was to be expected, was a continuous *zing*. To me it was not very loud or vigorous. In the early morning of June 21 I walked about the town and found a great many living *apache* and also many lying dead or nearly dead under some cottonwood trees and other trees along the streets. A native informed me that they were very common this year, perhaps more so than usual. I found a freshly emerged pupa crawling in the grass by the side of the road; also a male just developed and still limp and soft. I collected a number of pupae skins, also 72 male and 42 female adult cicadas, many of which had apparently died in the night and had fallen to the ground. They were in good condition. I also found a dead Cicada-killer, *Sphecius convallis* Patton and captured a living one.

At Indio the majority of the specimens were of the light brown variety of *apache*, as are those I have seen from other localities in California, and from Nevada and Utah. A few, however, were almost entirely black with the collar and wing veins straw-color or even green. In Arizona the dark variety is the prevailing form.

Diceroprocta eugraphica Davis.

On July 3, 1931, four males and three females were collected by the side of the road on various bushes on our way from Marathon, Texas, to Hot Springs on the Rio Grande. We found the

cicadas near to where the then dry bed of a stream crossed the road about 25 miles south of Marathon. The insects sang a low and continuous *zing*, as was to be expected. We went from Hot Springs to Mr. J. W. Potter's ranch near the base of the Chisos Mountains on July 5, and found *eugraphica* on some bushes near his garden. There was a small irrigated area, but the cicadas were on the slopes close by.

Diceroprocta bequaerti Davis.

This insect was considered a variety of *vitripennis* Say, in the paper on the Cicadas of the genus *Diceroprocta* in this JOURNAL for December, 1928, but not only is the head much larger than in *vitripennis* and the black stripe between the eyes does not reach the eyes as is usual in *vitripennis*, but also the obconical spots on the mesonotum have the posterior extremities more divergent and angulated than in that species. The collar is usually of a brighter green.

Dr. Raymond H. Beamer has sent for examination the following from Texas: a male from Aransas County, Aug. 6, 1928; 3 males and a female from Victoria Co., Aug. 9, 1928, and 4 males from Jackson Co., Aug. 9, 1928. Mr. F. F. Bibby has sent for examination a male from Sugarland, Cameron Co., Texas, June 20, 1929, and 6 males from Burleson Co., Texas, collected in July, 1930.

These specimens, and those already recorded in this JOURNAL as *bequaerti*, stand apart by the characters mentioned.

Diceroprocta swalei Distant, var. **castanea** Davis.

In the original description of *castanea* (= *swalei*) JOURNAL, N. Y. Ent. Soc., Vol. XXIV, pp. 49-51, March, 1916, is the statement: "One of the female paratypes constitutes a variety having the fore wings suffused entirely with brown, as well as about two thirds of the area of the hind wings." It is further stated that *Diceroprocta castanea* may prove to be a variety of *swalei*, but the name *castanea* can apply to the variety with the fore wings entirely suffused with brown, as shown in the female from the Santa Rita Mountains, Arizona, and included in the description. This is the female figured on plate 18, fig. 1, JOURNAL, N. Y. Ent. Soc., Vol. 36, December, 1928.

It is of interest that Prof. E. D. Ball collected 8 specimens of var. *castanea* in the Santa Rita Mts. June 22, 1930. He stated that he had additional specimens. With the above 8 specimens he sent 4 typical *swalei* from the Rincon Mts., Ariz. Among the specimens received from O. C. Poling in 1924, and collected in the Boboquivari Mts., there is one male that may be placed as variety *castanea*. It would appear, however, from the collections thus far made that in the Santa Rita Mountains, var. *castanea* is the prevailing form.

Cicada chisos Davis.

We found this species associated with *Tibicen inauditus* in the Davis Mountains, Texas, and 14 males and 2 females were collected from June 29 to July 2, 1931. On July 5 we collected two males and two females in the Chisos Mountains. The song is not like that of *Cicada hieroglyphica* of the eastern states and Mississippi valley, but is a pulsating or trembling *ticker-ticker-ticker*. Now and then the song rises higher, and then drops to half-strength again, but continues for a long time unless the insect is disturbed. As with *inauditus* this species was usually in the oaks, but was much shyer than *inauditus*, and as a result we collected but the 20 specimens, though many more were seen.

Okanagana schaefferi sub-species **tanneri** Davis.

This insect was described and figured in this JOURNAL for March, 1930, from the male type, collected at Woodside, Utah, and three additional males collected at the same locality. Since the description was published Prof. Vasco M. Tanner has sent me 5 males and 12 females of *tanneri*, all collected at Woodside, Emery County, Utah, at the same time as the type. According to his letter of November 7, 1930, about 24 specimens were retained by him, so it will be apparent that the insect occurred at Woodside in considerable numbers.

This is the first record of the female of *tanneri*, and an examination of the considerable series reveals, that, like the males, they much resemble *schaefferi*, except for the considerable differences in color.

Okanagana fumipennis new species (Plate V, figs. 1 and 2).

Type male and allotype female from near Fort Garland, Costilla County, Colorado, June 11, 1930 (Sherman C. Bishop and Richard C. Hart). Davis collection.

This showy black and reddish-orange-colored insect resembles *Okanagana schaefferi* (see figure in this JOURNAL, December, 1927), but may be separated from it by the thickened venation and by having the wings milky and clouded.

Head narrower than the front margin of the pronotum; front considerably produced and prominent. Median sulcus of the front well defined. Pronotum with the humeral angles rounded, the anterior angles prominent and the sides considerably amplified. Last ventral segment with the sides converging toward the rounded extremity. Last ventral segment of the female with the notch single and without an inner notch. In some of the paratypes the sides of the notch are sinuate. Uncus black; when viewed from behind, with a shallow notch at the extremity. The valve extends slightly beyond the uncus; is black with the upper margin pale; in some of the paratypes it is almost entirely pale.

Fore wings moderately broad, as in *schaefferi*, but with coarser veins, and milky clouded from the base to the row of marginal cells. Basal cell opaque, almost black, the veins darkened and mostly of the same color throughout. In *schaefferi* the veins extending to the marginal cells are pale. Both pair of wings at base, as well, as the anal membranes are reddish-orange, as in *schaefferi*. In the hind wings the milky cloud extends to the margin.

Head black, with supra-antennal plates edged with pale. Pronotum black with a short, median pale line and margined with orange. In some of the paratypes the narrow pale border to the anterior margin is wanting. Mesonotum black, the posterior margin, the elevated \times and anterior spots pale; also a pale spot each side at base of the fore wings. Metanotum margined posteriorly with orange. Tergum black, with the segments margined posteriorly with reddish-orange. Beneath black, the legs variegated with reddish-orange, especially at the joints, and each abdominal segment margined posteriorly with reddish-orange, the last one about one-half orange. In the female the space about the ovipositor is reddish-orange.

Measurements in Millimeters

	Male Type	Female Allotype
Length of body	28	27.0
Width of head across eyes	7	7.5
Expanse of fore wings	65	67.0
Greatest width of fore wing	11	12.0
Length of valve	5	

The first specimens of this species received were two females from Jemez Springs, New Mexico, June 17 and 26, 1919, 6,400 feet elevation, collected by Mr. John Woodgate. At that time they were supposed to be *schaefferi*. In June, 1928, Dr. John W. Sugden, of Salt Lake City, sent me 5 males and 3 females collected in San Juan County, Utah, June 8, 1928. In the letter accompanying the insects he stated that they came from the sage brush flats north of Monticello, and that many of them were singing while clinging to the stems of the sage. "They were easily captured; were poor flyers and none voluntarily took to wing. Their song was strong and long continued. Many of the cast skins were found on the stems and on the ground. The holes were level with the surface of the ground." On September 16, 1931, Dr. Sugden wrote of *Okanagana schaefferi* collected near Mt. Carmel, Utah, the previous June, that the song was long and continuous, and that when a large number were singing together that it reminded him of the sound made by the machines that resharpen safety-razor blades. "I do not remember receiving such an impression in the colony that was observed near Monticello, San Juan County, in 1928. The Mt. Carmel cicadas were all on the juniper, although there was sage brush in the region, but the San Juan cicadas were on sage there being no juniper in the region."

In July, 1930, Prof. Sherman C. Bishop sent me 14 males and 6 females of *fumipennis* from Costilla county, southern Colorado, collected by him and Mr. Richard C. Hart, June 11, 1930, and a male from the adjoining Alamosa county, collected June 26, 1930. This led to a re-examination of the specimens, from New Mexico and Utah, with the conclusion that a distinct species resembling *schaefferi* was represented.

Prof. Bishop writes: "The specimens in the long series from near Fort Garland were from sage brush bordering the highway, emerging, singing and mating, June 11, 1930."

Species of *Okanagana* are usually lacking in easily noticeable characters on which to found names, but this is not the case with *fumipennis* now known from three states.

Okanagana nigrodorsata Davis.

This species was described in this JOURNAL for March, 1923. Up to that time thirteen specimens, all from the northern half of California, had been examined. More recent records are Sequoia Park, Calif., July, female (Collection Los Angeles Museum); near Lake Tahoe, Calif., 7,500 ft., July 5, 1931, two females (E. R. Hulbirt); Mt. Elias near Lake Tahoe, 8,700 ft., male July 6, 1931, and 7 males July 7, 1931 (E. R. Hulbirt).

The twenty-four specimens thus far examined closely resemble one another, and the species may be told by its all black color and the peculiar orange tint at the base of the wings and of the costal margin of the fore wing to the end of the radial cell.

Okanagana bella Davis.

This species has been recorded from Kansas and all of the states westward except Nevada, where it no doubt occurs. It is also native of Alberta and British Columbia. In June, 1929, Mr. Douglas K. Duncan collected a female in the White Mountains of Arizona. It is of interest that in this considerable range, embracing about one third of the area of the United States, that the race *rubrocaudata*, found in the mountains of Colorado, and near Raton, New Mexico, is the only notable variety.

Okanagana viridis Davis.

On August 5, 1930, Mr. F. F. Bibby collected a single female *viridis* at Midway, Madison County, in the eastern part of Texas. The specimen is in the collection of the Texas Agricultural Experiment Station, College Station, Texas. The species was previously known from five specimens as recorded in this JOURNAL for March, 1925. They came from Mississippi, Arkansas and Tennessee.

Okanagana rubrovenosa Davis

Records of this beautiful insect, usually found on the manzanita bushes are given in this JOURNAL for 1919, p. 213, and 1926, p. 187. Lately its distribution has been extended from California to Arizona and Utah, and it no doubt occurs in Nevada as well.

Mr. Douglas K. Duncan of Globe, Arizona, wrote of *rubrovenosa* that he and Mr. Frank H. Parker had collected it at the base of the Pinal Mts., 3,000–4,000 ft. in June, 1930 on “the stems of manzanita brush, only a pair were taken being difficult to see or locate in the first place as their song is stilled when approaching them, and as you notice they are a very pretty red which well matches the stems of the manzanita bush making them almost impossible to locate. Several were noted as they flew when trying to locate them and a pair taken.” In 1931 Mr. Duncan sent two male *rubrovenosa* collected in May at the base of the Pinal Mountains, Arizona.

Dr. John W. Sugden of Salt Lake City, Utah, wrote of *rubrovenosa* as follows: “The black cicada with the red wings (Washington County, July 6, 1930) was taken on a shrub that grew three or four feet high and had red stems with many upturned scales on the bark of the larger stems. With wings folded, the cicadas were even more protected by the coloration than the *Okanagana striatipes* on the sage brush. The song was even, regular, but not of great volume.”

Okanagana vanduzeei Distant and var. ***consobrina*** Distant, compared with ***utaheneis*** Davis and ***californica*** Distant.

Okanagana vanduzeei is now known from California, Oregon, Idaho, Nevada and Utah. The pale variety *consobrina* has also been collected in Utah and Oregon. In the original description of *consobrina*, Ann. and Mag. of Natural History, Series 8, August, 1914, p. 166, Mr. Distant states, that it is like *vanduzeei* except that the “two small pale spots in front of the cruciform elevation are larger and appear as the apices of two ill-defined obconical spots to the mesonotum, the lateral abdominal margins beneath are almost entirely ochraceous, the venation to the basal areas of both tegmina and wings is ochraceous; structural characters as in *O. vanduzeei*, and the specimens are received from the same locality as that from which the typical species was derived,” namely, San Diego County, California.

In this JOURNAL for March, 1915, Mr. Van Duzee gives descriptions of *vanduzeei* and var. *consobrina* and states that the variety is generally larger and more hairy than *vanduzeei*.

While *Okanagana californica* Distant resembles *consobrina*, it is smaller "with the surface more polished, the colors clearer, the pale markings more extended and the surface less densely clothed with pale scale-like hairs" (Van Duzee). In the writer's collection there are over 130 specimens of *californica* collected in numerous localities in the southern part of California.

In 1917 Prof. W. S. Wright sent me a series of *vanduzeei* and var. *consobrina*, collected at Dulzura, California, in June, that show the resemblance of *consobrina* to *vanduzeei*, except in color, as mentioned by Distant.

Okanagana utahensis, now known from the states west of the Rocky Mountains can be separated from *vanduzeei* by not being as black and from it and variety *consobrina* by its larger size, more protruding front of the head, and by being less hairy.

Dr. John W. Sugden has sent me a considerable series of *utahensis* collected from several broods appearing in recent years near Salt Lake City, and he, as well as Dr. Raymond H. Beamer, have collected both *vanduzeei* and var. *consobrina* in Utah.

A series of 54 *Okanagana utahensis* was kindly collected for me by Mr. and Mrs. Ernest L. Bell on the desert to the south of Fallon, Nevada, June 24, 1930. The "large congregation of them extended along the trail for three quarters of a mile or so," wrote Mr. Bell, and the bushes were "filled with cicadas." Many of the specimens were soft, having but recently emerged.

All of these species are included in a table of *Okanagana* in this JOURNAL, 1919, pp. 182-187.

OKANAGODES

In June, 1931, the writer collected many rather large, pale straw-colored *Okanagodes* along the shore of the Salton Sea in California, and in July, 1931, Mr. C. H. Gable, Jr., found two small, green *Okanagodes* at Terlingua, Texas, in the Big Bend country to the west of the Chisos Mountains. The green specimens showed noticeable structural characters different from *gracilis*, the only recorded member of the genus. This led to an examination of the seventy specimens of *Okanagodes* now in the writer's collection. In a general way they could be separated into three groups: moderately sized, often pearly gray indi-

viduals with dorsal dark markings and moderately swollen fronts to their heads (*Okanagodes gracilis*); generally larger specimens of a pale straw-color, pale pink, or greenish color, with the front of the head more swollen (*Okanagodes gracilis* var. *pallida*), and lastly the small all green specimens from the Big Bend of the Rio Grande in Texas, with a differently shaped head and uncus from the other two (*Okanagodes terlingua*).

Okanagodes gracilis Davis, the type species of the genus described from Utah specimens, with dark markings on the upper surface, has also been recorded from Lower California, Bagdad, Calif. (Morgan Hebard) and Saltdale, Mojave Desert, Calif. (A. C. Davis); Mina, Nevada (E. W. Davis), and several localities in Arizona. An account of its habits, song, etc., by L. D. and R. H. Beamer appeared in this JOURNAL, for September, 1930. As with other Cicadas, the members of the various broods of this species usually bear a close resemblance to one another; they all will be of the typical form with dark markings, or almost immaculate, as in variety *pallida* which has broods of its own.

***Okanagodes gracilis* var. *pallida* new variety.**

Type male and allotype female from the shore of the Salton Sea, California, June 21, 1931 (Wm. T. Davis). Davis collection.

This is a rather large pale colored insect with the front of the head much produced and more swollen or enlarged than is usual in *gracilis*. The Cu 1 vein in the front wing is curved upward much as in some of the species of *Clidophleps* and with a distinct though small "fuscous nodus" at the margin of the fore wing where Cu 2 and Cu 1b meet. The transverse fold crossing the front wing at the node is more evident than is generally the case in *gracilis*. The two inner obconical spots that extend backward from the front margin of the mesonotum are outlined, and the outer pair are very faintly discernible, or may be entirely absent as in some of the paratypes. The general color is pale straw-colored, or in some of the paratypes greenish, or even pinkish. The dark mark at the extreme base of the under side of the abdomen is absent, as it usually is in *gracilis*. The veins surrounding the marginal cells in the fore wing are darkened, the eyes are dark and the ocelli ruby colored, as in other *Okanagodes*.

This was a very common insect on the low vegetation close to the southwestern shore of the Salton Sea, California, not far

Measurements in Millimeters

	Male Type	Female Allotype
Length of body	23	23
Width of head across eyes	6	6
Expanse of fore wings	54	58
Length of valve	4	

from the road that now runs parallel to the lake through the Coachella Valley. Twenty males and eleven females were collected June 21, 1931, during the short time that we were at the side of the lake. All of the specimens are of a nearly uniform straw-color. The song was a low and continuous *zing*. The insects were not shy and were easily collected.

In the original description of *Okanagodes gracilis* in this JOURNAL, Vol. 27, p. 221, 1919, several of the specimens mentioned from Arizona as paratypes should be transferred to variety *pallida*.

Okanagodes terlingua new species. (Plate V, figs. 3 and 4)

Type male from Terlingua, Brewster County, Texas, July, 1931 (C. H. Gable, Jr.). Davis collection.

A small species with the front of the head and supra-antennal plates not as prominent as in either *gracilis* or *pallida*. The hook at the end of the uncus has the sinuation on the lower part less evenly curved than in *gracilis*, as shown in the illustration herewith and in that in this JOURNAL, Vol. 27, p. 221, 1919. The Cu 1 vein in the fore wing is almost straight and more nearly parallel to Cu 2; not curved upward as in *gracilis* and variety *pallida*. The transverse fold crossing the front wing at the node, and the node itself are obscure and hardly exist. There are four obconical, pale marks on the mesonotum extending backward from the anterior margin, the inner pair not as long as the outer pair. These marks are prominent in *gracilis* and but faintly represented in variety *pallida*. The eyes

Measurements in Millimeters

Length of body	17.0
Width of head across eyes	4.0
Expanse of fore wings	42.0
Length of valve	3.5

are brownish; the ocelli ruby colored; the general color green including the venation, except near the margin of the fore wings, where the veins are slightly darkened about the marginal areas. The base of the wings and about the tympana slightly yellowish green; beneath, the usual dark mark at extreme base of abdomen. This mark is absent in the single male paratype, which otherwise is like the type.

PLATYPEDIA

In "North American Cicadas Belonging to the Genera *Platypedia* and *Melampsalta*," published in this JOURNAL, June, 1920, ten species of *Platypedia* and three varieties of *Platypedia putnami* are described, and most of them figured. In this JOURNAL for 1921, *Platypedia laticapitata* is described on page 14, and *P. latipennis* on page 54. During the past few years it has become apparent that there exists a variety of *mohavensis* described in 1920 from Trumbull Mountain, northwestern Arizona, and two varieties of *Platypedia rufipes* described in 1920 from California. These varieties or geographic races with structural and color differences, may ultimately be considered as separate species when more specimens have been collected.

***Platypedia mohavensis* variety *rufescens* new variety** (Plate VI, figs. 1 and 2).

Type male, Jemez Springs, New Mexico, 6,400 feet, June 24, 1919, and allotype female from the same locality, June 14, 1919 (John Woodgate). Davis collections.

This variety has the uncus flat at the extremity and of the same shape as that figured for *mohavensis* in this JOURNAL, June, 1920, page 100, and also shown on the accompanying plate. It has thus far been found to the eastward of typical *mohavensis* and is conspicuous in having the pale orange of the costal margin of the fore wings, the membranes at the base of all

Measurements in Millimeters

	Male Type	Female Allotype
Length of body	19.0	18.5
Width of head across eyes	5.0	5.0
Expanse of fore wings	42.0	44.0
Greatest width of fore wing	8.0	8.0
Length of valve	4.5	

of the wings, and the paler parts of the body and legs replaced by red-orange or even red. In a typical *mohavensis* having the same expanse of wings as in the type of variety *rufescens*, the greatest width of a fore wing is 9 millimeters instead of eight.

In 1918, 1919 and 1920 I received from Mr. John Woodgate of Jemez Springs, N. M., 61 specimens of variety *rufescens*; Mr. Warren Knaus has sent me 4 specimens collected four miles southeast of Santa Fé, N. M., on the old Santa Fé Trail in scrub pine and cedar, June 15, 1918, with the statement that they made a "*snap, snap, snap noise*"; Mr. George P. Engelhardt has given me two males and two females collected at Estancia, N. M., June, 1929, and I have a male collected by Prof. Sherman C. Bishop and Richard C. Hart, June 21, 1930, 5 miles west of Ojo Caliente, N. M. Dr. Raymond H. Beamer has sent me for examination 64 males and 50 females of variety *rufescens* collected at Tajique, N. M., June, 1931, by Mr. J. G. Shaw, in which the fore wings are as usual narrower than in typical *mohavensis*. They were very numerous, and collected on pine, cedars, black locusts and oaks.

The specimens from Bondad, Colorado, and Chaves, New Mexico, mentioned in the original description of the species, should be transferred to variety *rufescens*. Owing to the different appearance of the New Mexican specimens collected in 1918 and 1919 by Mr. Woodgate they were not included in the original description of *mohavensis*.

***Platypedia rufipes* var. *bernardinoensis* new variety.** (Plate VI, figs. 4 and 5)

Type male and allotype female, Cactus Flats, San Bernardino Mountains, California, June 8, 1925 (Alonzo C. Davis). Davis collection.

Variety *bernardinoensis* is a much larger insect than typical *rufipes* with darker colored legs and the venation of the fore wings black or nearly so, except for the costal margin which is orange, as are the membranes at the base of all of the wings and the paler markings of the body. In typical *rufipes* the venation of the fore wings is pale to the marginal cells.

In the original description of *rufipes* it is stated that: "In the collection of the California Academy of Sciences there is a large male with wings expanding 52 millimeters, from Bear Lake, San Bernardino Mts., Cali-

foria, May 17, 1919 (J. O. Martin), that is considered here on account of the form of the uncus which resembles that of the type of *rufipes* except that it is much straighter along the lower line. The front of the head is prominent; the fore femora are chestnut colored, darkened beneath; femora of middle and hind pairs of legs striped with black; tibiae blackened at the basal joints. The fore wings have the costal margin bright orange to the end of the radial cell, but the remainder of the venation is darker than in the seven specimens of *rufipes*. This insect may belong to a distinct species."

The above is an accurate description of var. *bernardinoensis* and we give a figure of the specimen from Bear Lake on Plate VI, figure 4.

Measurements in Millimeters

	Male Type	Female Allotype
Length of body	21.0	20.0
Width of head across eyes	5.5	6.0
Expanse of fore wings	48.0	50.0
Greatest width of fore wing	9.5	9.5
Length of valve	5.0	

For comparison with *bernardinoensis* the original figure of the type of *rufipes* is here reproduced on Plate VI, figure 3.

In addition to the type and allotype Mr. Alonzo C. Davis sent me thirteen specimens of *bernardinoensis*, here placed as a variety, but like the next so called variety, is probably a distinct species.

***Platypedia rufipes* var. *angustipennis* new variety.** (Plate VI, figs. 7 and 8)

Type male and allotype female, Buckman Springs, San Diego County, California, June 23, 1925 (Prof. W. S. Wright). Davis collection.

Variety *angustipennis* differs from *rufipes* in being larger, in having the eyes more prominent, the venation of the fore wings (except the costal margin, which is orange), black or nearly so. In typical *rufipes* the venation of the fore wings is pale to the marginal cells. The membranes at the base of both pairs of wings are darker orange (or even red) in variety *angustipennis*, and the legs are blacker.

There are 33 paratypes of *angustipennis* in the writers collection, all collected in June, 1925, by Prof. Wright. Also two

Measurements in Millimeters

	Male Type	Female Allotype
Length of body	20.0	19.0
Width of head across eyes	5.5	6.0
Expanse of fore wings	48.0	50.0
Greatest width of fore wing	8.5	9.0
Length of valve	5.0	

females from Los Angeles Co., California without date (B. Neubath).

In the Sierra Ancha Mountains, Gila County, Arizona, there is a narrow winged *Platypedia* with the uncus as in variety *angustipennis*, and closely resembling it in other respects except that it is a little smaller. Mr. George P. Engelhardt collected a male, June 15, 1927, and I have received three males and six females from the same mountains collected in July, 1929, by D. K. Duncan and Frank H. Parker.

In closing this paper we give the following note on *Platypedia putnami* described by Uhler from Colorado, Bull. U. S. Geological and Geographical Survey of the Territories, iii, p. 455, 1877. It is copied from a letter kindly presented to me by Mr. John D. Sherman, Jr., and written by J. Duncan Putnam to Prof. Philip R. Uhler:

“Academy of Natural Sciences, Davenport, Iowa,

“June 27, 1877.

“Dear Mr. Uhler

“Your letter of May 11th and the pamphlets on Western Hemiptera were duly received and I am greatly obliged.

“I was quite surprised on turning over the pages to happen upon *Cicada putnami* and of course I felt pleased that so peculiar a species should be new. I found [it] not uncommon along the banks of Clear Creek between Floyd’s Hill and Idaho Springs on July 2d, 1872 and never at any other time. They were on shrubs—willow, birch or maple growing close to the edge of the water. The males make a peculiar very faint chirp.

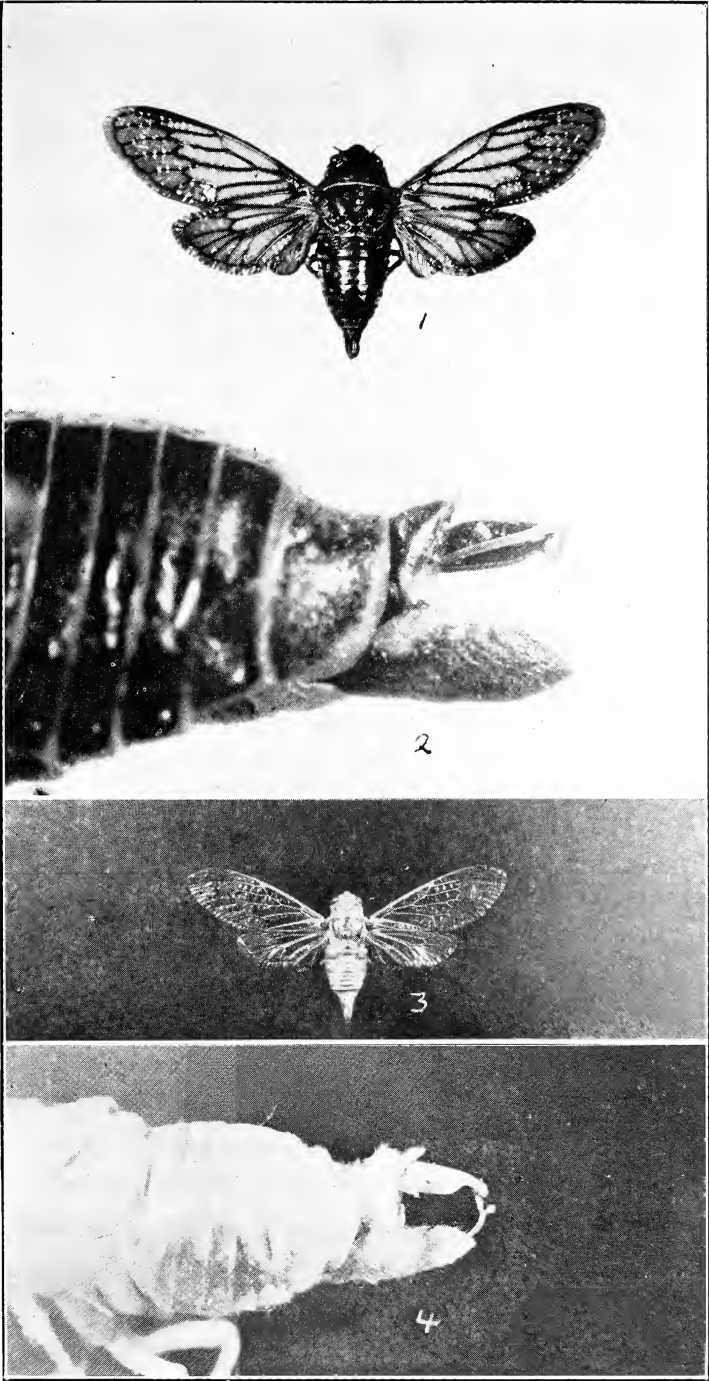
.

“Sincerely your friend,

“J. Duncan Putnam.”

PLATE V

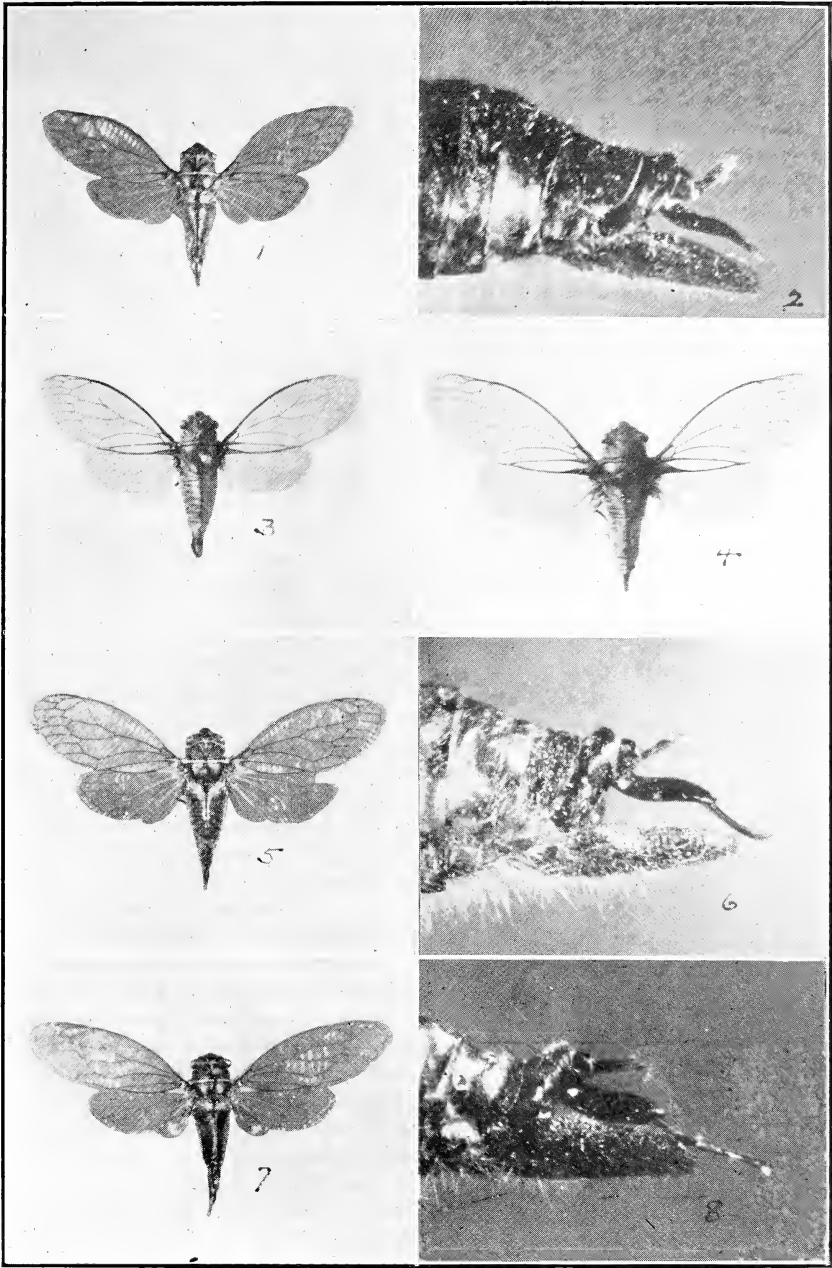
- Figure 1. *Okanagana fumipennis*. Type.
Figure 2. *Okanagana fumipennis*. Enlarged extremity of abdomen of type.
Figure 3. *Okanagodes terlingua*. Type.
Figure 4. *Okanagodes terlingua*. Enlarged extremity of abdomen of type.



CICADIDÆ

PLATE VI

- Figure 1. *Platypedia mohavensis* var. *rufescens*. Type.
Figure 2. *Platypedia mohavensis* var. *rufescens*. Enlarged extremity of abdomen of type.
Figure 3. *Platypedia rufipes*. Type figure reproduced.
Figure 4. *Platypedia rufipes* var. *bernardinoensis*. Coll. Calif. Acad. Sciences.
Figure 5. *Platypedia rufipes* var. *bernardinoensis*. Type.
Figure 6. *Platypedia rufipes* var. *bernardinoensis*. Enlarged extremity of abdomen of type.
Figure 7. *Platypedia rufipes* var. *angustipennis*. Type.
Figure 8. *Platypedia rufipes* var. *angustipennis*. Enlarged extremity of abdomen of type.



CICADIDÆ

NOTE. The pale spots on the wings, and sometimes on the bodies of the insects, are due to high-lights in the photographs.

PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY

MEETING OF MAY 19, 1931

A regular meeting of the New York Entomological Society was held on May 19, 1931, in the American Museum of Natural History; President Andrew J. Mutchler in the chair with twenty-two members and eight visitors present.

The minutes of the preceding meeting were approved as read.

Mr. Curran suggested that the meetings for the coming year be conducted as symposia, the discussion being led by various individuals.

Three cicadas collected by Mr. Bell in Jamaica were exhibited by Mr. Davis. Mr. Davis spoke of *Diceraprocta* found not only along the shore of the southeastern coast of Jamaica, but also in Cuba, Grand Cama, and on the eastern coast of Florida.

Dr. Lutz gave an interesting account of the apparatus used and the results obtained from observations on the rhythm of activity of *Gryllus domesticus*.

Mr. Curran informed the society of a most valuable catch at Cold Spring Harbor, New York, namely two specimens of *Glutops singularis*. Only eleven or twelve specimens are known to have been captured and most of these in the vicinity of Ithaca, New York.

Mr. Lacey spoke of his success in winter collecting at Pelham, New York, during which time he had collected one specimen new to the New York State List, i.e., *Neoharmonia venusta* (Melsheim).

Mr. Klein said his activities had been watching the emergence of damselflies from their cocoons on his table.

Mr. Moennich reported a carabid taken on April 4; an elaterid and a carabid on March 3; and a longicorn and a scolytid on May 10.

A woodbine feeding moth (pupa from Texas) was observed to hatch on May 19 by Mr. Englehardt.

Butterflies were scarce at Lakehurst, New Jersey, on May 10, according to Mr. Watson's observations. However, the first spring specimen of *Pyrgus tessellata* (Scudder), a male, was collected there on that day by Mr. S. A. Hessel. Mr. Watson spoke of the Museum's recent acquisitions of lepidopterous specimens from New Guinea, South America, and from Panama.

Mr. Wurster had observed male specimens of *Io* that were devoid of color, all in drab olives and gray, on emergence from the cocoon.

European specimens of *Papilio hospitans* from Corsica and Sardinia were exhibited by Mr. Hall.

Mr. King of the Japanese Beetle Parasite Laboratory at Moorestown, New Jersey, reported the appearance of colonies of *Tiphia* (Corean) at

Wilmont, Penna. In using both dipterous and hymenopterous parasites, the Laboratory had found that the dipterous parasites were giving the better results in aiding in the extermination of the Japanese beetle.

Mr. Curran spoke of a *Procena* which occurs in northern Japan.

Mr. de Ghika reported the appearance of a great variety of larvæ on wild raspberry, particularly *vasiliata*. Devia was found in March and continued until the fallow bloom.

Mr. Mutchler exhibited some cicindellids from Jamaica.

Mr. Ragot related a gruesome tale of some vultures that descended upon him while lying on the ground one day at noontime in Florida. Their quarry, however, was not Mr. Ragot but his lunch.

Dr. Pierce related some of his experiences with Strepsiptera and fungi in the Philippines, which will appear in "Short Notes" in the Journal.

MEETING OF OCTOBER 6, 1931

A regular meeting of the Society was held in the American Museum of Natural History on October 6, 1931; President Andrew J. Mutchler in the chair with twenty members and six visitors present.

The minutes of the preceding meeting were approved as read.

The program committee made a report for the next meeting.

Itineraries for entomologists in Europe in 1932 were distributed among the members.

The members gave the following reports on their Summer collecting. All agreed that insects had been plentiful during the summer months.

Mr. Angell had caught a specimen of *Sequas elevartus* on October 4.

Mr. Bromley gave an interesting account of a new species of tortricid attacking white pine, which is being described by Mr. Heinrich. Two incrustations of the Chinese mantis had been found in the region of Stamford, Connecticut. Despite the damp weather, vespids were abundant, the worst injury to fruit trees being done by *Vespis vulgaris*.

Mr. Curran described a curious habit of aquatic chironomous larvæ which had been observed to remove the posterior segments only of some twenty earthworms.

Mr. Davis exhibited a copy of the recent publication, "My Nature Nook," by W. S. Blatchley, and read some of the numerous references to Florida insects. Mr. Davis stated that the angled-winged katydid, *Microcentrum rhombifolium*, had been common in Staten Island gardens. On September 18, 1931, the windows on one of the Staten Island ferry boats had been attractive to many species of moths in their flight from the south. *Alabama argillacea*, *Heliothus obsoleta*, *Prodenia ornithogolli*, and *Laphyma frugiperda* were noticed especially. On September 27, a male black witch moth, *Erebus odora*, no doubt another migrant from the south, was found in a culvert on Staten Island. Mr. Davis read a reference to the abundance of monarch butterflies on October 1, 1798, in the diary of William Dunlop, 1780-1784, recently published by the New York Historical Society.

Mr. Klein spoke briefly on the dragonflies of northern New Jersey.

In speaking of his trip to Pasadena with Messrs. Davis and Englehardt, for the annual meeting of the A. A. A. S., Dr. Lutz mentioned the trap-door spiders that he had brought back with him in their own burrows. His son had called his attention to the alternating green and red eyes of the angled-winged katydid. The study of this phenomenon is now in the hands of Dr. Kendall of the Histology Department of the City College of New York.

Mr. Moennich had sent the results of his collecting on the dunes of Cape Cod to Mr. Leng. He had found from five hundred to a thousand beetles.

Mr. Lacey reported some clerids and some microscopic beetles found on the shore at Westport, Connecticut. He had had success in attracting nitidulids with pear bait.

Mr. Nicolay said that beetles had had a bad season at St. Simons Island, Georgia. Chrysomelids and weevils were present but cicindellids and others were scarce, the best collecting being in old abandoned houses. He reported an eastern monstrosity, *Cicindela purpurarea* from Lakehurst, New Jersey.

Messrs. Curran and Lutz led a discussion on the correlation between fleas and infantile paralysis, during which Simon Flexner's article on infantile paralysis in Science was quoted as disagreeing with any such correlation.

Mr. Sherman gave some interesting facts concerning the Knopf publication of Wheeler's translation of Reamur's "Natural History of Ants" together with the original. Decaying bark in the northern White Mountains of New Hampshire had yielded some Carabidæ during September.

Mr. Wurster displayed the dark male Io that he had bred and also a normal individual which is brilliant yellow.

Mr. Watson's report on Lepidoptera collected during the summer will appear in "Short Notes" of the Journal.

MEETING OF OCTOBER 20, 1931

A regular meeting of the Society was held on October 20, 1931, in the American Museum of Natural History; President Andrew J. Mutchler in the chair with twenty-one members and twenty-two visitors present.

The minutes of the preceding meeting were approved as read and corrected.

The report of the treasurer, Mr. G. C. Hall, was accepted as read.

It was unanimously agreed by the members to omit the regular meeting of the Society on November 3, 1931, it being coincident with Election Day, and to hold the next regular meeting on November 17, 1931.

As an introduction to Dr. Lutz's paper on "The Fauna of the Thermal Waters of Yellowstone National Park" (Novitates No. 498), Dr. Melander gave a short talk with carefully colored slides, to illustrate the great variety of brilliant colors and also the chemical content of the various geysers and their overflows and terraces in the Yellowstone National Park.

Dr. Lutz then read his paper, speaking of the educational nature work that was being done to acquaint the public with our National Parks; the

various museums located throughout the Yellowstone National Park, each specializing in a different feature of the natural history of the park, and also the work of the National Geographic Society along this line. In making careful observations on a stream in the Old Faithful geyser district, Dr. Lutz concluded that "temperature seems to be a controlling inorganic factor in the distribution of animal life, although the chemical characteristics should be more thoroughly considered and observed."

Dr. Copeland of City College of New York spoke briefly on the botany of the thermal waters.

Messrs. Curran and Mutchler commented on their identifications of the specimens of Diptera and Coleoptera brought back from Yellowstone National Park by Dr. Lutz.

Mr. Curran read a newspaper notice of the death of H. L. Viereck in an automobile accident in the Middle West. Mr. Curran reviewed Mr. Viereck's life and his work in Hymenoptera.

MEETING OF NOVEMBER 17, 1931

A regular meeting of the New York Entomological Society was held on November 17, 1931, in the American Museum of Natural History; President Andrew J. Mutchler in the chair, with twenty-five members and twenty-nine visitors present.

Mr. C. H. Curran was appointed to act as secretary in the absence of Miss Sherman. The minutes of the preceding meeting were read and adopted.

The program committee reported that Dr. Lutz would give the concluding part of his paper on "Migration" at the following meeting and that another speaker would be announced in the Academy Bulletin.

The following were proposed for membership in the Society: Messrs. Charles Ballou, Harold C. Hallock, S. Hessel and Edgar G. Rex.

Dr. Lutz presented his paper, "Insect Migration, Part 1—The General Problem."

Dr. M. D. Leonard spoke briefly on outbreaks of Alabama argyllacea in Porto Rico and suggested that its appearance at various seasons of the year might indicate that Porto Rico might be a natural center of dispersal, the moths migrating north or south from this point.

Dr. Lutz pointed out that the great flights of the cotton boll worm adults to the north in the autumn could not be explained by temperature changes as suggested by Dr. Leonard as their flight carried them into a region of low temperatures.

Dr. Ernest N. Cory then read his paper on "Some Phases of Entomology in Maryland." Dr. Cory traced the history of Entomological work in Maryland from the appointment of Dr. C. V. Riley as head of the Department of Physiology and Entomology, in 1893, to the present time. The Department of Entomology was separated from Zoology in 1919 and all phases of the work of the department is centered under one head. It is believed that regulatory work should be 99 per cent. educational and this

feature has worked excellently in the state. The department has a fairly good library and in addition carries on extension, teaching and research work, the latter mostly in connection with fruit and field crop insects. Why certain insects have failed to secure a hold in Maryland has always been an interesting problem. Among the insects mentioned the Gypsy and Browntail moths have failed to become established in Maryland, although it is reasonable to suppose that numerous egg masses were imported on nursery stock before the enactment of quarantine No. 37. About 1,400 nests of the browntail moth were found on imported stock in the years 1909 and 1910. Only one grasshopper outbreak has occurred in the state during Dr. Cory's connection with the department and outbreaks of codling moth, oriental peach moth and pea aphid have been sporadic. The Japanese beetle has not spread nor increased sufficiently to damage foliage or sod at Cambridge, where it has been present for five years. The presence of spotted fever in Maryland is causing some concern. Three species of ticks, *Dermacentor variabilis*, *Ixodes hexagonus* and *Haemaphysalus leporis-palustris*, have been collected in the spotted fever areas but so far have failed to give positive reactions. Dr. Cory extended a welcome to collectors to visit Maryland and promised every assistance in making their visits profitable.

Dr. Lutz explained that the belief of many people that the group of milkweed butterflies in the hall of insect life is exaggerated is erroneous. Actually this group represents only a small part of the great clusters of butterflies which at one time collected on certain trees in Connecticut during migration.

Dr. Cory stated that he had failed by twenty-four hours to witness a clustering of monarchs at Solomon's Island, Chesapeake Bay, Maryland, on September 24th of this year.

Mr. Curran spoke briefly on migration this year as observed by Dr. Sherwood, director of the Museum of Natural History. The migration, as observed at the spot where the Museum group was obtained, seemed to extend over an unusually long period and the nightly gatherings of the butterflies was small.

Mr. Angell stated that he had records of two species of lucanids from Maryland, *Lucanus elephas* and *Pseudolucanus capreolus*. This is a northern record for *elephas* while a dark variety as well as the typical form of *capreolus* occurred.

Mr. Hadley said that there was no real evidence of migration in regard to the Japanese beetle but there might be a definite movement or concentration. Establishment of the beetle in distant places was undoubtedly due to commerce. This insect provides an opportunity for tracing the rapid development of insects. A few were discovered in 1916 by Mr. H. B. Weiss at Riverton, N. J., and a few years later thousands were present. It will probably spread over the eastern half of the United States during our lifetime.

Mr. J. R. Wade extended a welcome to members of the Society to attend the meetings of the Entomological Society of Washington and reported that they had had excellent meetings this year. The Bureau of Entomology is now located in temporary buildings.

Dr. C. Crosby expressed his pleasure at being able to attend one of the meetings of the Society and remarked upon the control of potato beetles.

Mr. Englehardt drew the attention of the members to Böving and Craighead's paper on North American Beetle larvæ published in *Entomologica Americana*.

Mr. Davis showed specimens of *Scepsis fulvicollis* collected on Staten Island on October 20th and pointed out that in the State List of Insects the dates given were May to October. Mr. Lemmer reported taking the species this year at Lakehurst, N. J., about the middle of November.

MEETING OF DECEMBER 1, 1931

A regular meeting of the New York Entomological Society was held in the American Museum of Natural History on December 1, 1931; President Andrew J. Mutchler in the chair with thirty-four visitors and twenty-two members present.

The minutes of the preceding meeting were approved as read.

The program committee reported that Dr. Edward F. Roberts of the Lederle Laboratories would be the speaker at the next meeting.

Messrs. Ballou, Hallock, Hessel and Rex were elected active members of the Society.

Mr. Watson read a review of the new and revised edition of Dr. Holland's "Butterfly Book" which will appear in the Journal of the Society.

Mr. Davis exhibited five specimens of cicadas; four from China taken by Mr. Herclots, and one from Laguna, Philippine Islands, taken at light by Miss Irene D. Dobrosky. He pointed out the lack of bilateral symmetry in the markings on the hind wings of the two *Platypleura hilpa* Walker, from near Hong Kong, China. In both males the band near the end of the hind wing failed to reach the hind border on the left side, while the hind border was reached by the band on the right side. It was thought remarkable that the same irregularity should appear in the same way on both specimens. All of the cicadas were sent by our member, Miss Dobrosky, who is rearing parasites in the Philippines to be sent to the Experimental Station of the Hawaiian Pineapple Cannery. Miss Dobrosky describes Laguna as an entomologist's paradise. "There are leaf hoppers as big and beautiful as butterflies," she writes. "The sun sets all too quickly for a collector, but even at night the collecting is fine around lights. I eat my dinner with a cyanide bottle in one hand and one eye cocked on the swinging bowl-like chandelier."

Dr. Lutz reviewed with very favorable comments Williams' book on the "Migration of Butterflies," reaching the conclusion that, in spite of a great deal of observational data, we really know nothing definite concerning either the cause of the mass-movements of insects or the factors which

direct them. The experimental work of Rowan on birds was reviewed but it was felt that, applying the mathematical law of random dispersal, Rowan had not proved induced migration and that even his proof of increasing ordinary activity is open to some doubt. The best experimental work on the factors concerned in the mass-movements of insects has been done with migratory locusts. In this connection the work of Uvarov and others was discussed in some detail.

Dr. Felt read his paper on "The Control of Insects Affecting Shade Trees and Ornamentals." The scanty foliage and dead limbs of many of the shade trees throughout the state is a deplorable condition. A shade tree is entitled to as much protection and care as a fruit tree. Only a healthy tree has a high resistance to such pests as the bronze birch borer, the red cedar and the chestnut borers. To overcome the effect of drought, the placing of food, such as humus, for a considerable area around the base of the tree and also the use of fertilizer is necessary. The outgrowth of injury may be accomplished in the same way. The controls for the elm leaf beetle and the Japanese beetle are not sufficiently effective on ornamentals. Also it must be understood that the dormant season is the time to use the controls. It is impossible to change the environment of a tree without incurring serious damage.

Mr. Davis exhibited a male *Colias* butterfly which was either *eurytheme* or *philodice*, no conclusion having been reached though the specimen had been examined by a number of the members before being brought to the meeting. The butterfly greatly resembled *philodice*, except for a flush of orange below the discal spot of each fore wing as in many specimens of *eurytheme*. The fore wings are narrowly margined with black as is usual with *philodice*, and beneath, it also resembles that species. It and many other *Colias* were flying about near the docks at Tompkinsville, Staten Island, on November 22, 1931, when the thermometer recorded 71 degrees (F.). Mr. Davis called attention to the article in the Scientific Monthly for August, 1931, by Austin H. Clark on the "Extirpation of One Butterfly by Another," which includes observations on *Colias eurytheme* and *C. philodice*. The first named butterfly has steadily invaded the territory of *philodice* during recent years.

Mr. Curran called attention to the fact that *Eristalis brousi*, a species native to the eastern United States, has been driven west of the Mississippi River by the foreign species *arbustorum*, which has taken possession of the territory east of the Mississippi.

Mr. Watson reported the following late records of butterflies seen:

Colias philodice (Godart), 2 individuals, and *C. eurytheme* (Boisduval), 2 individuals, at Garden City, L. I., on November 22, 1931, by J. T. Nichols. Also, *Colias philodice* (Godart), 3 individuals and one large dragonfly with a blue abdomen, possibly *Anax junius*, were taken in Central Park, New York City, on November 24, 1931, by Mr. Watson.

MEETING OF DECEMBER 15, 1931

A regular meeting of the New York Entomological Society was held in the American Museum of Natural History on December 15, 1931, at eight o'clock; President Andrew J. Mutchler in the chair with twenty-five members and twenty-three visitors present.

The minutes of the preceding meeting were approved as read and corrected.

The program committee announced that Dr. Harvey Bassler would be the speaker at the next meeting, which would be the Annual Meeting of the Society. Also the committee reported a series of topics on the Biology of Insects to be given at the various meetings through the spring of 1932.

Mr. Watson read a communication to the Society concerning the collection of Phytometrinæ which Dr. R. Ottolengui has donated to the Museum and which has been incorporated in the Museum collection and is available for students' use.

Messrs. Davis, Bromley and Horsfall were appointed as a nominating committee of the officers for 1932-1933, to report at the next meeting.

Dr. Edward F. Roberts, of the Lederle Laboratories at Pearl River, New York, read his most interesting paper "The Clinical Application of Blow Fly Larvæ."

Dr. Roberts then showed two reels of motion pictures of the work of Dr. McClellan, of Pittsburgh, showing the stages of development and the breeding of the maggots, and the treatment of wounds in cases of chronic osteomyelitis with the wonderful results of this treatment.

Also, the members were privileged in seeing Dr. Baer's own lantern slides of his method of maggot therapy and the results of his work.

In response to Dr. Lutz's motion, there was a rising vote of thanks to Dr. Roberts for his interesting paper.

Mr. Sherman exhibited a copy of *Bibliographie Entomologique* by Charles Nodier, published in Paris in February, 1801 ("An IX"), the first entomological bibliography, a small work $3\frac{1}{2}'' \times 6\frac{1}{4}''$ of viii + 64 pp. and exceedingly rare, due to the author's efforts to destroy the entire edition, after it had been rather severely criticized. The only other copy ever seen by Mr. Sherman is in the Library of Congress. The entire work is reproduced on pages 241-278 of the volume on Nodier published by Hermann in 1911, with a preface by Bouvier. The author of the 1911 book mentions the great difficulty he had in obtaining a copy of the original work.

ANNUAL MEETING, JANUARY 5, 1932

The thirty-eighth annual meeting of the New York Entomological Society was held in the American Museum of Natural History on January 5, 1932; President Andrew J. Mutchler in the chair with twenty-one members and thirty-nine visitors present.

The minutes of the preceding meeting were approved as read.

The treasurer, Mr. Hall, announced that his report would be ready at the next meeting.

The librarian, Mr. Watson, reported the accessions to the library during 1931.

The nominating committee submitted the following nominations for officers for 1932-1933: Andrew J. Mutchler, President; Ernest L. Bell, Vice-president; Elizabeth Sherman, Secretary; Gaylord C. Hall, Treasurer; Frank E. Watson, Librarian; Andrew J. Mutchler, Curator; Executive Committee, Wm. T. Davis, Dr. Wm. Moore, Herbert F. Schwarz, Howard Notman, Henry Bird; Auditing Committee, E. L. Bell, Dr. E. K. Schwarz, Dr. E. R. P. Janvrin; and Delegate to the New York Academy of Sciences, William T. Davis.

There being no other nominations, it was moved that the secretary cast an affirmative ballot re-electing these officers and committees for 1932-1933. This was accordingly done.

President Mutchler re-appointed the following committees: Publication Committee, Harry B. Weiss, C. W. Leng, J. D. Sherman, Jr., C. E. Olsen; Program Committee, C. H. Curran, Harry B. Weiss, J. L. Horsfall; Field Committee, A. S. Nicolay, and Mrs. Nicolay.

The program committee reported Dr. Wm. Moore and Prof. C. L. Fluke as speakers at the next meeting.

Mr. Davis exhibited a copy of the *Bulletin of the New York Public Library*, for December, 1931, containing an article by Mr. Harry B. Weiss entitled "William Charles, Early Caricaturist, Engraver and Publisher of Children's Books"; also, the January, 1932, number of the *American Book Collector*, of which Mr. Weiss is co-editor. This magazine contains an interesting review by Mr. Weiss of a rare pamphlet on banking by Rafinesque, best known to us as a describer of plants. Mr. Weiss, it was pointed out, had become one of the chief historians of the early writers on American entomology, as well as being the co-author of the life of Thomas Say, the father of that branch of science in America.

Mr. L. R. Colt, of Fountain Valley School, Colorado Springs, was proposed for membership in the Society. On motion, Mr. Colt was elected an active member of the Society.

On motion, the resignation of Mr. John M. Sheridan and Mr. Erdman West were accepted.

Professor Herbert Ruckes, of the College of the City of New York, read his paper on "Sex Determination and Intersexes," the first of a series of papers on the Biology of Insects to be given during the year by various specialists. "In insects sex is determined at the time of fertilization. The mechanism for this lies in the constitution or the chromosomal make-up of the germ cells. In the majority of insects that have been studied the male cells (sperm) are distinct from the female cells (egg) inasmuch as the males have either an XO or an XY set of sex chromosomes in addition to the normal autosomes of the cell, while the females have a set of XX chromosomes in addition to the normal autosomes. This makes the male

cells the sex determiners. In the Lepidoptera the situation is reversed, for here the females are the sex determiners and the formula for the germ cells, in order to keep the types distinct, is for the male cells ZZ, and for the female WZ.

"Two kinds of sex determination are recognized by the zoologist; that which is called *zygotic*, such as is illustrated in the insects where the sex is determined at the time of fertilization by the combination of the sex chromosomes, and the *hormonic*, such as occurs in the vertebrates, where after the sex is determined at fertilization it may be modified by the action of endocrine or hormone producing glands. In this paper we are concerned only with the former case, since Meisenheimer, Oudemans, Hegner and others have conclusively proved, by experiments on transplants of gonads and by castrations that there is apparently no hormone that plays a rôle in insects as there is in the vertebrates.

"The major part of the paper was given over to a discussion of the work of Goldschmidt (Richard) who in his paper on "*Erblichkeitsstudien an Schmetterlingen*" studied and explained the cases of intersexes in *Lymantria dispar*, the gypsy moth.

"Goldschmidt discovered that if a male of a Japanese race of *L. dispar* is crossed with a female of a European race, the males of the F₁ generation are all normal but the females give evidence of some intersexuality, *i.e.*, there are some females that have secondary male sexual characters. This work led to other crosses being made, between males of many Japanese races and females of either, different Japanese races, or of European races. The results gave a completely graded series from one extreme in which the abnormal females showed only slight degree of intersexuality to the other extreme where the females were all male in their appearance. Goldschmidt explained that it was necessary to assign arbitrary numerical values to the sex determining chromosomes of both the male and the female cells, and in addition place a sex determining value on the cytoplasm or other parts of the chromosomal constitution.

"In the chromosomal formula ZZ WZ he added another factor F which would stand for femaleness. The arbitrary values assigned are as follows:

$$\begin{array}{ccc} F & W & Z \text{ (Female, called by Goldschmidt FmM)} \\ 80 & 0 & 60 \end{array}$$

in which case the factor F had 20 units more strength than the factor Z (M), hence the appearance of female characteristics.

$$\begin{array}{ccc} F & Z & Z \text{ (Male, called by Goldschmidt FMM)} \\ 80 & 60 & 60 \end{array}$$

in which case the combined factors ZZ (MM) totaled 120 units or 40 units greater than the single factor F, hence the appearance of male characteristics.

"Since different races could have different values for the potential of the sex chromosomes, it stands to reason that crosses could be made in which the relationship between the units for femaleness and maleness could be

different than the ones above assigned. When a female appears with the constitution in which the chromosomal potential leans toward the male proportion, the individual, while yet female can exhibit male characteristics. If the proportion between female factors and male factors totals 0 (zero) then there appears a pure intersex, a female in body but with all external male characters, such as a cross made between a weak European female and a strong Japanese race male, *i.e.*

European race ♀			and	Strong Japanese race ♂		
F	m	M		F	M	M
80	0	60		100	80	80

gives: normal males

intersex females with the formula:

F	m	M
80	0	80

a ratio between the sex potentials
of 0 (zero)."

The Society was honored by the presence of Dr. T. D. A. Cockerell and Mrs. Cockerell, who had just disembarked from their ship on their return from an extended trip through Africa, including the provinces of Angola, Belgian Congo, the Transvaal, and Cape Province. Dr. Cockerell spoke very briefly on the remarkable opportunities for any and all collectors in Africa. Their party of five had travelled with ease and comfort during the dry season, and had had great success in the various fields for which they were collecting.

Dr. Harvey Bassler spoke on "The Entomological Contacts of a Tropical Geologist," relating his many interesting experiences at Iquitos on the Amazons of Brazil and Peru and in the head-hunter country of Peru. *Stegomyia*, *Culex quinquetans* are the domestic mosquitoes of Inquitos, while the most troublesome sylvan species are those belonging to *Psorophora* and certain rain-pool breeding species which belong to the genus *Aedes*, also *Monsonia indubitans* is very conspicuous in this respect. *Anopheles darlingii* is the principal malaria carrier on the Upper Amazon. *Anopheles gambii* has been introduced very recently from West Africa to Brazil. The edible grub from palm trees is probably *Dynamis borassi* (Fabr.) closely similar to the well known *Rhyncoporus palmarium* of the Caribbean region and the coastal area of South America. The "train grub" whose head is phosphorescent red, tail a phosphorescent green, and the segments of whose body give the appearance of a double row of white lights belongs to the family Phengodidae. The larvæ of *Dynamis* are called "suri" in Eastern Peru and the larva of *Dermatobia hominis* is called "sututo." The great ponerine ant, *paraponera* is called "insula."

Dr. Bassler then showed lantern slides which gave the high lights of travel and living conditions on the Amazon and in the foothills of the Andes. He also exhibited two very excellent specimens of the dried heads which are prepared by the head-hunter tribes of Peru. The female head and the male head had been reduced to approximately one third their normal size.

The New York Entomological Society

Organized June 29, 1892—Incorporated June 7, 1893

The meetings of the Society are held on the first and third Tuesday of each month (except June, July, August and September) at 8 P. M., in the AMERICAN MUSEUM OF NATURAL HISTORY, 77th Street and Columbus Avenue.

Annual dues for Active Members, \$3.00; including subscription to the Journal, \$4.50.

Members of the Society will please remit their annual dues, payable in January, to the treasurer.

Officers for the Year 1932

President, ANDREW J. MUTCHLER..... American Museum of Natural History, N. Y.

Vice-President, ERNEST L. BELL..... 150-17 Roosevelt Ave., Flushing, Long Island

Secretary, ELIZABETH SHERMAN..... 132 Primrose Ave., Mt. Vernon, N. Y.

Treasurer, GAYLORD C. HALL..... 144 E. 22nd St., New York

Librarian, FRANK E. WATSON..... American Museum of Natural History, New York

Curator, A. J. MUTCHLER..... American Museum of Natural History, New York

EXECUTIVE COMMITTEE

WM. T. DAVIS

DR. WM. MOORE

HERBERT F. SCHWARZ,

HOWARD NOTMAN,

HENRY BIRD.

PUBLICATION COMMITTEE

HARRY B. WEISS,

CHARLES W. LENG

JOHN D. SHERMAN, JR.,

C. E. OLSEN.

PROGRAM COMMITTEE

C. H. CURRAN

HARRY B. WEISS,

J. L. HORSFALL

AUDITING COMMITTEE

E. L. BELL,

DR. E. K. SCHWARZ,

DR. E. R. P. JANVRIN.

FIELD COMMITTEE

A. S. NICOLAY,

MRS. A. S. NICOLAY

DELEGATE TO THE N. Y. ACADEMY OF SCIENCES

WILLIAM T. DAVIS

JOURNAL

of the

NEW YORK ENTOMOLOGICAL SOCIETY

Published quarterly by the Society at Lime and Green Sts., Lancaster, Pa. All communications relating to the Journal should be sent to the Publication Committee, New York Entomological Society, American Museum of Natural History, New York City; all subscriptions to Lime and Green Sts., Lancaster, Pa., or to the Treasurer, Gaylord C. Hall, 144 E. 22nd St., New York City, and all books and pamphlets to the Librarian, Frank E. Watson, American Museum of Natural History, New York City. Terms for subscription, \$3.00 per year, strictly in advance. *Please make all checks, money-orders, or drafts payable to New York Entomological Society.*

Twenty-five reprints without covers are furnished free to authors. Additional copies may be purchased at the following rates:

	4 pp.	8 pp.	12 pp.	16 pp.	24 pp.	32 pp.
25 copies	\$2.40	\$5.22	\$5.58	\$5.58	\$9.00	\$9.60
Additional 100's .....	.60	1.44	1.92	1.92	3.00	3.00
Covers	50 copies, \$2.50; additional 100's, \$1.50.					
Half-tone prints 1½ cents for each half-tone print.						

Authors whose papers are illustrated with text figures or full page plates will be required to supply the electrotypes or pay the cost of making the same by the Journal and also to pay the cost of printing full page plates on coated paper, when advisable.

VOL. XL

SEPTEMBER, 1932

No. 3

JOURNAL
OF THE
NEW YORK
ENTOMOLOGICAL SOCIETY

Devoted to Entomology in General



SEPTEMBER, 1932

Edited by **HARRY B. WEISS**

Publication Committee

HARRY B. WEISS

CHARLES W. LENG
C. E. OLSEN

J. D. SHERMAN, JR.

Published Quarterly by the Society

LIME AND GREEN STS.
LANCASTER, PA.
NEW YORK, N. Y.

1932

Entered as second class matter July 7, 1925, at the post office at Lancaster, Pa., under the Act of August 24, 1912.

Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized March 27, 1924.

Subscription \$3.00 per Year.

CONTENTS

The North American Species of the Genus <i>Limnophora</i> Robineau-Desvoidy, with Descriptions of New Species (Muscidæ, Diptera). BY H. C. HUCKETT	279
Synopsis of the Cicindelidæ, I. BY ALAN S. NICOLAY and HARRY B. WEISS	341
Three New Species of <i>Exptochiomera</i> from the United States (Hemiptera-Lygæidæ). BY H. G. BARBER	357
Neocloeon, a New Mayfly Genus (Ephemera). BY JAY R. TRAVER	365
A New Form of <i>Hyloicus</i> Discovered in Ecuador by W. Judson Coxey. BY W. SCHAUS	375
The Food of <i>Batrissodes globosus</i> (Lec.), (Coleop.: Psela- phidæ). BY ORLANDO PARK	377
Five Sericine Beetles. BY ROBERT J. SIM	379
New Records of Lepidoptera from New York. BY ALEXANDER B. KLOTS	385
Book Notice	389
"Necrophorus" or "Nicrophorus." BY MELVILLE H. HATCH	391
Errata	391
NOTICE: VOLUME XL, NUMBER 2, OF THE JOURNAL OF THE NEW YORK ENTOMOLOGICAL SOCIETY WAS PUBLISHED ON JULY 5, 1932.	

JOURNAL

OF THE

New York Entomological Society

VOL. XL

SEPTEMBER, 1932

No. 3

THE NORTH AMERICAN SPECIES OF THE GENUS LIMNOPHORA ROBINEAU-DESVOIDY, WITH DESCRIPTIONS OF NEW SPECIES (MUSCIDÆ, DIPTERA)

(Continued from page 158)

BY H. C. HUCKETT

RIVERHEAD, N. Y.

Limnophora (Spilogona) compuncta Schnabl and Dziedzicki, Abh. d. Kaiserl. Leop.-Carol. Deutsch. Akadem. d. Naturforsch., 1911 XCV Nr. 2 p. 154.—Collin, Ent. Month. Mag., 1921 ser. 3 VII pp. 97. 166.—Séguy, Faune de France, No. VI 1923 p. 212.—Karl, Tierwelt Deutschlands, 1928 Th. XIII p. 101.—Collin, Trans. Ent. Soc. London, 1930 LXXVIII Pt. 2 p. 277, pls. 17. 24.

The species has been recorded by Coquillett (8) in his list of diptera occurring on the Commander Islands. I have not seen these specimens and hence am not able to verify the record. I have before me a male and female specimen of *compuncta* from Sweden, sent by Mr. O. Ringdahl, which in my opinion differ from the following species recorded from Alaska, although the two species are closely allied.

In the European specimens the frons including the frontal vitta is lightly whitish pollinose, the proboscis is highly polished, the hypopleura has a single setula on upper margin cephalad of metathoracic spiracle, the mid tibia has no ventral bristle, and has two well developed anterodorsal bristles, the bristles on the

anteroventral surface of hind femur are well developed, even on proximal half, and the first abdominal sternum has numerous setulæ. In addition, the male abdomen is broadly ovate, with densely cinerous pruinescence on dorsum when viewed from behind, and with well defined blackish areas on ventral aspect of terga, which become brownish marks when viewed from in front. Terga 1 + 2 largely blackish, with grayish pollen along the caudal margin, tergum three with a pair of trapezoidal marks, tergum four with a pair of narrower, subtriangular marks, tergum five with a blackish to brownish fuscous area along dorsocentral plane, such markings confined to dorsum of abdomen. Processes of fifth abdominal sternum with a marked constriction at apex on inner margin, which is smooth and highly polished.

In the female the mesonotum has only a well marked dorsocentral vitta, the scutellum is entirely grayish, terga 1 + 2 largely grayish pollinose with two small brownish spots, terga three and four with paired roundish marks on dorsum, tergum five at most with trace of dorsocentral marking, terga three, four, and five with large brownish areas on venter, anal plates of ovipositor with short fine spinules, fore tarsal segments slender, not broadened.

***Limnophora (Spilogona) alliterata* new species**

MALE, blackish; parafrontals and parafacials whitish pruinulent, cheeks duller, with dark reflections; frontal vitta black, viewed from below with light brownish pollen; frontal triangle polished; antennæ and palpi black; proboscis with trace of pruinescence. Thorax blackish, subshining, with at most a trace of brownish pruinescence, with a presutural dorsocentral vitta when viewed from above and in front, otherwise the mesonotum and scutellum are entirely blackish. Abdomen densely brownish gray pruinulent, with conspicuous brownish black, paired marks on terga 1 + 2, 3, and 4, with a lighter brownish dorsocentral mark on tergum 5. Legs black, pulvilli brownish tinged. Wings lightly infuscated, darker basad. Calyptræ yellowish tinged. Halteres deep yellow.

Eyes separated by a distance wider than breadth of third antennal segment; frontal vitta narrow, gradually broadening cephalad, distinctly separating the parafrontals caudad; parafrontal bristles in series to a level approximating the anterior ocellus, those on caudal half of series much weaker than those on cephalic half; parafacials, at base of antennæ, about equal in breadth to that of third antennal segment, considerably narrower ventrad; cheeks slightly higher than width of third antennal seg-

ment, with a series of weak upturned bristles along ventral margin, and with a number of short bristles and setulæ adjoining the vibrissæ.

Thorax with acrosticals setulose; with four pairs of postsutural dorso-central bristles; sternopleural bristles arranged 1:1.

Abdomen broadly ovate, with conspicuous paired marks, which become successively smaller and more widely separated caudad, those on terga 1+2 large and expansive, narrowly separated at middle, those on terga three and four slightly arcuate in outline, tergum five with a lighter dorso-central mark; basal sclerite of hypopygium pollinose; first sternum with setulæ.

Fore tibia with a fine median posteroventral bristle; mid femur with a complete series of fine longish anteroventral setulæ which become stouter basad, with a series of fine bristles on proximal two-thirds of posteroventral surface; mid tibia with or without a short anterodorsal bristle, with 1 or 2 posterior bristles, and with or without a median posteroventral bristle; hind femur with a complete series of anteroventral bristles, those on proximal half shorter and finer than those on distal half, with a series of fine bristles on proximal half of posteroventral surface; hind tibia with 2 or 3 anteroventral, and 2 or 3 anterodorsal bristles, with or without 1 or 2 weaker posterodorsal bristles. Pulvilli robust.

Wings with veins *R.* 4+5 and *M.* 1+2 divergent toward wing margin; *m-cu* cross vein sinuate, oblique; costal thorns very small.

FEMALE, similar to male, thorax and abdomen more densely grayish pollinose, with intensive seal brown markings. Parafrontals brownish infuscated along border of frontal vitta; proboscis lightly pollinose. Thorax with five brownish vittæ, the median three more pronounced, with a more or less narrow transverse infuscated area immediately caudad of transverse suture; scutellum with large brownish areas at basal angles. Abdominal markings concolorous with those of thorax. Wings clear, veins dark brown.

Head from in front much broader than high; frontal vitta wider at narrowest than length of third antennal segment; parafrontals setulose; proboscis stoutly developed. Abdomen with three pairs of expansive marks on terga 1+2, 3, and 4 respectively, each pair distinctly separated at middle, those on terga three and four arcuate in outline; with or without indications of a dorsocentral vitta on terga three and four. Ovipositor with fine spinules on anal plates.

Fore tibia with 1 or 2 posterior bristles, irregularly placed; mid femur with a series of short bristles on proximal half of posteroventral surface; mid tibia with or without a short anterodorsal bristle, with 2 posterodorsal bristles, and with or without a posteroventral bristle; hind femur with fine bristles on proximal half of posteroventral surface; hind tibia with 2 or 3 anteroventral, and 2 or 3 anterodorsal bristles, with 1 or 2 setulose bristles on posterodorsal surface. Fore tarsus with conspicuous fine sensory hairs at apex of each segment on antero- and posteroventral surfaces; pulvilli short.

Length, 5.5-7 mm.

RECORDS:—

1 ♂, 3 ♀, Naknek Lake, Savonoski, Alaska, July 1919; 1 ♂, 3 ♀, August 1, 1919; 1 ♂, August 1919. (J. S. Hine) 2 ♀, Banff, Alta. July 4, 1925. (Owen Bryant) 1 ♂, 2 ♀, Tennessee Pass, Colo., 10240 ft. July 11.—(J. M. Aldrich)

Type and allotype in collection of Professor J. S. Hine, Columbus, Ohio. Paratypes in collection of the United States National Museum.

The species very closely resembles *compuncta*, especially in the male sex, and there is a probability that this was the species recorded by Coquillett (8) as *compuncta*. However, in comparison with European specimens of the latter species there are certain significant differences present in the female of *alliterata* which, in my opinion, justify the separation of the species on taxonomic grounds.

In the female of *alliterata* the thorax is intensively marked by three to five vittæ, the scutellum has broad patches at basal angles of scutellum, the markings on the abdomen are arcuate in outline, and the bristles on proximal half of anteroventral surface are weakly developed, setulose, whereas in *compuncta* the thorax has only a median vitta, the scutellum is entirely grayish pollinose, the abdominal marks are roundish and restricted in area, and the bristles on anteroventral surface of hind femur are stoutly developed, even to base.

The males of *alliterata* may be distinguished from those of *compuncta* by the lack of well developed bristles on anterodorsal surface of mid tibia, by the lack of a marked apical process or attenuation on inner margin of processes of fifth abdominal sternum which is highly polished, and by the weaker development of those bristles on proximal half of anteroventral series of hind femur.

There is a third species related to the above two, namely *novæ-angliæ*, which in the female may be readily distinguished by the presence of a stout mid ventral bristle on mid tibia, and in the male by the lack of a median posterior bristle on fore tibia, and by having the first sternum of abdomen bare.

The male of the specimens collected in Colorado differs essentially from those taken in Alaska in having the parafrontals contiguous, thereby reducing the distance between the eyes.

Limnophora (Spilogona) trilineata new species

MALE, blackish; parafrontals and parafacials densely silvery pruinose; cheeks with duller pruinescence, with reddish to blackish reflections; frontal vitta black with trace of brownish pruinescence; frontal triangle and proboscis polished; antennæ and palpi black. Thorax subshining, with three broad bandlike vittæ on mesonotum, with paler pruinose streaks along the planes of dorsocentral bristles and on lateral declivities of mesonotum; scutellum subshining, blackish, with a more or less obscure paler pruinose area on discal surface. Abdomen densely pale grayish pruinose, with dark reflections; terga 1+2, three, four, and five with paired blackish marks, tergum five with brownish infuscation; basal sclerite of hypopygium lightly grayish pruinose. Legs blackish, pulvilli brownish tinged. Wings smoky, more densely infuscated basad; calyptræ tinged with yellowish brown; halteres deep yellow.

Eyes with numerous hairs, separated by a distance equal to that between posterior ocelli; parafrontals contiguous caudad; frontal vitta considerably broadened cephalad; parafrontal bristles continued in series caudad to about level with apex of frontal triangle; parafacials at base of antennæ broader and cheeks higher than width of third antennal segment, the former but little constricted ventrad, the cheeks well maintained caudad.

Thorax densely setulose, acrosticals setulose, postsutural dorsocentral bristles four pairs, sternopleural bristles arranged 1:1, mesopleural series of bristles with one or two intermediate predorsal bristles.

Abdomen conical, terga 1+2 largely blackish, faintly divided at middle; terga three and four with marks sharply defined, those on tergum three trapezoidal, on tergum four subtriangular, the latter smaller and more widely separated than those on tergum three; tergum five with a pair of small subtriangular marks restricted caudad.

Fore tibia with no median posterior bristle: mid femur with a few weak short bristles on proximal third of anteroventral surface, with 5 strong straight bristles on proximal half and a series of fine longish setulæ on distal half of posteroventral surface; mid tibia with 3 posterior bristles: hind femur with 3 or 4 bristles on distal half of anteroventral surface, posteroventral surface with no series of bristles; hind tibia with 2 anteroventral, and 2 anterodorsal bristles, and with or without 1 or 2 weaker bristles on posterior surface. Wings with veins *R.* 4+5 and *M.* 1+2 divergent towards wing margin.

FEMALE, paler than male; head with dense grayish brown pruinescence; parafrontals with brownish infuscation; frontal vitta black; frontal triangle brownish pruinose. Thorax densely pollinose, with three narrow brownish vittæ between the dorsocentral bristles, and broader vittæ laterad; scutellum with brownish areas at basal angles; macrochætæ set in brownish spots. Abdomen grayish pollinose; terga 1+2 largely grayish pollinose; with trace of brownish marks on terga three and four; tergum five with a brownish dorsocentral vitta. Wings faintly tinged, slightly infuscated basad; veins brownish. Calyptræ yellowish.

Eyes with a few inconspicuous hairs; chaetotaxy of thorax similar to that of male. Abdomen with traces of brownish marks on terga 1+2, terga three and four with widely separated subtriangular marks; ovipositor with spinules on anal plates.

Fore tibia with no posterior bristle: mid femur with 4 bristles on proximal half of posteroventral surface; mid tibia with 2 posterior bristles: hind legs missing.

Length, 6 mm.

RECORDS:—

1 ♀, Carcross, Yukon Territory, July 21, 1919. (H. G. Dyar)

1 ♂, Anchorage, Alaska, June 6, 1921. (J. M. Aldrich)

Type and allotype in the United States National Museum.

The species is to be readily distinguished from other North American forms of this genus by the hairy eyes and by the peculiar form of the vittæ on mesonotum. In the males the eyes are particularly hairy, and the thorax has three broad, ribband-like vittæ lying within and without the planes of the dorsocentral bristles when viewed from in front: in the female the dorso-central marking is subdivided into three narrow distinctive vittæ, all of which lie between the series of dorsocentral bristles.

The species most closely resembles the European species *depressiuscula* Zett. specimens of which have been kindly sent to me for comparison by Mr. Ringdahl after he had examined the American specimens.

Limnophora (*Spilogona*) *imitatrix* (Malloch)

Melanochelia imitatrix Malloch, Canad. Ent., 1921 LIII p. 64.—

Frison, Bull. Ill. Nat. Hist. Surv., 1927 XVI Art. 4 p. 204.

Male blackish; parafrontals and parafacials silvery pruinulent; cheeks not so densely pruinulent, with dark reflections; antennæ and palpi black; proboscis polished. Thorax blackish, subshining, with trace of grayish brown pruinescence; abdomen densely grayish brown (cinereous) pruinulent; terga 1+2 largely blackish; terga three, four, and five with paired blackish marks, those on tergum five more or less fused and less distinctively colored than those on previous segments; hypopygium and fifth sternum blackish, lightly pollinose, subshining. Legs blackish, pulvilli tinged. Wings lightly infuscated, more deeply so basad and on membrane adjoining the proximal half of costa:

calyptre whitish; halteres yellowish brown, with trace of purplish.

Head with eyes relatively large, separated by a distance slightly greater than diameter of anterior ocellus; parafrontals, parafacials, and cheeks restricted: parafrontal bristles strongly developed, continued in series caudad to about level with apex of frontal triangle; parafrontals contiguous, thereby restricting the frontal vitta; parafacials at base of antennæ narrower than breadth of third antennal segment, but little narrowed ventrad; cheeks about as high as length of third antennal segment, with a series of prominent upcurved setulæ along the ventral margin; antennæ short.

Thorax with presutural acrosticals setulose, with four pairs of postsutural dorsocentral bristles; sternopleural bristles arranged 1:1; mesopleural series of bristles with one or two weak intermediate predorsal bristles.

Abdomen with markings on each successive segment decidedly smaller than the ones preceding, restricted to dorsum of terga; terga three and four with marks trapezoidal, on the former segment the marks are broader than long and are narrowly separated, on the latter segment the marks are longer than broad and are more distinctly separated; tergum five with narrow subtriangular areas, closely adjacent; processes of fifth sternum with dense setulæ.

Fore tibia with no posterior bristle: mid femur with a series of 2 or more erect bristles on proximal half of posteroventral surface, most of which are very stoutly developed; mid tibia with 2 or 3 posterior bristles: hind femur with 5 bristles on distal half of anteroventral surface, proximal half of posteroventral surface bare; hind tibia with 2 anteroventral, and 3 anterodorsal bristles, and with 2 weaker posterior bristles.

Wings with veins *R.* 4+5 and *M.* 1+2 divergent toward wing margin; *m-cu* cross vein erect, but slightly sinuate.

Female paler in color than male; head grayish pruinulent; parafrontals with brownish infuscation along border of frontal vitta; proboscis highly polished. Thorax densely grayish pruinulent, with a distinct brownish dorsocentral vitta, and with brownish sublateral areas not so well defined; scutellum with

brownish marks at basal angles, otherwise densely grayish pruinulent. Abdomen grayish pruinulent, subshining, with paired, brownish marks on terga 1 + 2, three, and four; tergum five with a brownish dorsocentral vitta. Wings clear, veins yellowish brown; halteres yellow.

Parafrontals with a few setulae, parafacials at base of antennae as wide and cheeks fully as high as breadth of third antennal segment. Abdominal marks widely separated, those on terga three and four subtriangular; ovipositor with fine setulae on anal plates. Mid femur with 2 or 3 posteroventral bristles; hind femur with 3 to 5 bristles on distal half of anteroventral surface, otherwise bristling of legs similar to that of male.

Length, 5 mm.

RECORDS:—

- 1 ♂, Bering Island, July–August 1922. (L. Stejneger) 1 ♂, Banff, Alta., June 29, 1925; 2 ♀, July 5, 1925. (Owen Bryant) 1 ♂, Hopedale, Labrador, July 7, 1923; 1 ♀, July 8, 1923.

This species was included by Malloch in his key to the North American forms of *Spilogona* (= *Melanochelia* Malloch *nec* Rondani) without further description. The type which had evidently been designated and is to be found in the collection of the Illinois Natural History Survey, is from Nain, Labrador. All the specimens of this species that I have examined, including the type, have four pairs of postsutural dorsocentral bristles, and not three pairs as indicated in Malloch's key.

The species resembles *bisetosa* (p. 300) in that the mid femur of male possesses a series of very stoutly developed, erect, bristles on posteroventral surface, the wings are densely infuscated basad, and the hind femur has no bristles on proximal half of posteroventral surface. However in *imitatrix* the thorax has four pairs of postsutural dorsocentral bristles, the mesopleural series of bristles has 1 or 2 weakly developed intermediate predorsal bristles, and the processes of fifth abdominal sternum have a dense series of short setulae at base adjoining the inner border, whereas in *bisetosa* the thorax has three pairs of postsutural dorsocentral bristles, the mesopleural series of bristles has no accessory predorsal bristles, and the processes of fifth

abdominal sternum have no dense series of setulæ at base. In the female these differences also hold true except for the fifth abdominal sternum.

The male specimen from Berling Island differs from those from Labrador or Alberta in having the abdominal marks on tergum three fused across the dorsocentral plane, and on tergum four the marks are triangular in shape, the inner margins of which are divergent cephalad.

***Limnophora (Spilogona) brevicornis* (Malloch)**

Tetramerinx brevicornis Malloch, Canad. Ent., 1917 XLIX p. 226.—Malloch, Ent. News, 1918 XXIX p. 32.—Frison, Bull, Ill. Nat. Hist. Surv., 1927 XVI Art. 4, p 209.

Limnophora brevicornis Malloch, Trans. Amer. Ent. Soc., 1920 XLVI No. 802 p. 148.

Melanocheilia brevicornis Malloch, Canad. Ent., 1921 LIII pp. 62. 63.

RECORDS:—

Alberta, 2 ♂, 3 ♀, Lake Newel, June 9, 1923. (Walter Carter)

Montana, 1 ♂, Yellowstone Lake, Aug. 9, 1918. (A. L. Melander)

Wyoming, 1 ♀, U. Geyser Basin, Yellowstone Park, Aug. 7, 1918. (A. L. Melander)

Colorado, 1 ♂, no locality nor date label.

New York, 1 ♀, Essex Co., Lot 46.

Quebec, 1 ♂, Roberval, July 28, 1913. (G. Beaulieu); 1 ♀, Ciaticook, Sept. 10, 1913. (J. I. Beaulne)

Maine, 1 ♀, Machias, July 17 —.

The species was described from Illinois, females having been captured on the shores of Lake Michigan. The type and allotype are in the collections of the Illinois Natural History Survey, Urbana.

In color of pruinescence the species resembles *cretans*, but that species has bristles on proximal half of posteroventral surface of hind femur, and the hind tibia has only one strong bristle on anterodorsal surface of hind tibia. The male of *brevicornis* may be readily recognized by the peculiar marking on the mesonotum, and the female by the large densely grayish pruinose

frontal triangle of head, and by the presence of stout spinelike hooks on the suranal plate of ovipositor. The mesonotum of the male, when viewed from above and in front, is grayish white pruinulent with a more or less obscure brownish dorsocentral vitta on the presutural area, and a rectangular, spotlike brownish mark between the first and third pairs of postsutural dorsocentral bristles.

***Limnophora (Spilogona) incauta* new species**

MALE, brownish gray; parafrontals and parafacials whitish pruinulent; cheeks duller, with dark reflections; frontal vitta blackish, viewed from below with brownish pruinulence; frontal triangle pollinose; antennæ and palpi blackish; proboscis polished. Thorax grayish, subshining, mesonotum with prominent brownish dorsocentral and narrow sublateral vittæ; lateral marks more or less obscure; scutellum largely grayish with brownish marks at basal angles. Abdomen lightly grayish brown pruinulent, subshining, with a narrow brownish interrupted dorsocentral vitta; terga 1+2 largely grayish when viewed from behind; terga three and four with paired brownish black marks; tergum five infuscated on caudal half; macrochætæ set in brownish spots; basal sclerite of hypopygium blackish, subshining. Legs blackish, pulvilli brownish. Wings tinged faintly, but little, if any, darker basad; cross veins clear. Calyptræ yellowish; halteres yellow.

Eyes separated by a distance about equal to twice that between posterior ocelli; frontal vitta distinctly separating parafrontals throughout their entire length; parafrontal bristles strongly developed, continued in series caudad to a level approaching that of anterior ocellus; parafacials at base of antennæ about as wide as width of third antennal segment; cheeks higher than greatest width of parafacials.

Thorax with acrosticals setulose, with four pairs of postsutural dorsocentral bristles; sternopleural bristles arranged 1:1.

Abdomen cylindrico-conical; markings on terga three and four subtriangular, widely separated and restricted to dorsum; sternum five with numerous fine longish setulæ.

Fore tibia with 2 posterior bristles; mid femur with a series of fine short anteroventral bristles, and with a series of 6 posteroventral bristles on proximal half; mid tibia with 1 or 2 anterodorsal, and 2 posterior bristles; hind femur with 4 anteroventral bristles on distal half, and a series of fine setulæ on proximal half of anteroventral surface, posteroventral surface with the setulæ on median third stronger developed than those on proximal or distal third; hind tibia with 1 or 2 anteroventral, and 2 or 3 anterodorsal bristles, and with 2 or 3 weaker posterior bristles.

Wings with veins *R.* 4+5 and *M.* 1+2 divergent towards wing margin; *m-cu* cross vein slightly sinuate.

FEMALE, paler in color than male, parafrontals, parafacials, and cheeks brownish gray pruinulent; parafrontals with brownish infuscation along border of frontal vitta. Thorax more densely grayish pollinose than in male, otherwise similar; abdominal marks variable, abdomen with or without a dorsocentral vitta; terga 1+2 uniformly grayish pruinulent, terga 3 and 4 with paired brownish marks. Wings yellowish tinged, especially basad; veins yellowish brown.

Parafrontals with a few setulæ, parafacials and cheeks in profile wider than breadth of third antennal segment; buccal area of cheeks with few, if any, setulæ along ventral margin; sternopleural bristles arranged 1: 2.

Abdominal marks indefinite in outline and size, widely separated; ovipositor with fine setulæ on anal plates.

Fore tibia with 1 or 2 posterior bristles: mid femur with a series of bristles on proximal half of posteroventral surface; mid tibia with 1 or 2 anterodorsal, and 2 or 3 posterior bristles: hind femur with 4 or 5 bristles on distal half of anteroventral surface, and with or without 1 to 3 longish setulæ on posteroventral surface; hind tibia with 1 or 2 anteroventral, and 2 or 3 anterodorsal bristles, and with 2 or 3 weaker posterior bristles.

Length, 6.5 mm.

RECORDS:—

1 ♀, Naknek Lake, Savonoski, Alaska, June 1919; 1 ♂, 1 ♀, July 1919; 1 ♀, July 27, 1919. (J. S. Hine)

Type and allotype in the collection of Professor J. S. Hine, Columbus, O.

Two of the above females have three pairs of postsutural dorsocentral bristles; the allotype has a series of three and four such bristles; the male has four pairs of postsutural dorsocentral bristles and this number I have assumed to be the normal number.

In the females there is also a considerable degree of variation in the development of the setulæ on posteroventral surface of hind femur, whilst in the single male specimen the setulæ are much stronger developed on median third than on proximal or distal third of posteroventral surface. The male specimen has two setulæ on the first abdominal sternum.

The species most closely resembles *rufitarsis*, from which it differs in the male through the shape of the abdomen and in the color of fore tarsi and calyptræ: in the female of *rufitarsis* the parafacials are relatively narrow, being constricted ventrad, whereas the cheeks are relatively broad, being higher than breadth of parafacials at base of antennæ: in *incauta* the para-

facials and cheeks are moderately broad, the former being scarcely narrower ventrad than at base of antennæ.

***Limnophora (Spilogona) fuscomarginata* new species**

MALE, blackish; parafrontals and parafacials silvery pruinulent; cheeks whitish pruinulent with dark reflections; frontal vitta black with whitish pruinescence; frontal triangle and proboscis polished; antennæ and palpi black. Thorax largely blackish, subshining, with trace of brownish pruinescence on mesonotum, vittæ obscure; humeral and notopleural callosities grayish. Abdomen with grayish pruinescence on cephalolateral angles of terga three, four, and five; terga 1+2 largely blackish, terga three and four with large expansive black marks, tergum 5 with narrow marks which are more or less obscured by infuscation on caudal half; basal sclerite of hypopygium blackish, subshining; processes of fifth sternum with the inner border reddish brown in color. Legs black; pulvilli brownish tinged. Wings smoky, more intensively infuscated basad: calyptræ tinged; halteres yellow.

Eyes separated by a distance about equal to breadth of third antennal segment; frontal vitta narrow, linear caudad, separating the parafrontals throughout; parafrontal bristles strongly developed, series extending caudad to almost level with anterior ocellus; parafacials linear in profile, at base of antennæ narrower than breadth of third antennal segment; cheeks about as high as width of third antennal segment, with a series of upturned setulæ along ventral margin.

Thorax with two closely adjacent series of presutural acrostical bristles, the latter fine and setulose, with four pairs of postsutural dorsocentral bristles; sternopleural bristles arranged 1:1.

Abdomen narrowly conical, terga 1+2 with marks obscurely separated at middle, terga three and four with marks subtriangular, more or less distinctly divided at middle, tergum five with narrow obscure triangular marks; processes of fifth sternum clothed with fine setulæ and a few weak bristles along inner border.

Fore tibia with no posterior bristle: mid femur with a series of short weak anteroventral bristles which become appressed on distal third, with a series of longish bristles on proximal two-thirds of posteroventral surface; mid tibia with 1 anterodorsal and 2 posterior bristles: hind femur with 3 or 4 bristles on distal third of anteroventral surface, and a series of short weak setulose bristles on proximal two-thirds of anteroventral and posteroventral surfaces, the bristles not readily distinguished; hind tibia with 2 anteroventral, and 2 or 3 anterodorsal bristles, and with 2 weaker posterior bristles. Wings with veins *R.* 4+5 and *M.* 1+2 subparallel; *m-cu* cross vein erect, or slightly sinuate.

FEMALE, paler than male; parafrontals, parafacials, and cheeks grayish pruinulent, the former with trace of brownish infuscation along border of frontal vitta; frontal vitta black with grayish frontal triangle; thorax

and abdomen grayish, subshining; mesonotum with three brownish vittæ; scutellum with brownish marks at basal angles; abdomen with brownish paired marks on terga 1+2, three, and four; tergum five with brownish dorsocentral vitta and infuscation on caudal half. Wings slightly tinged, *r-m* and *m-cu* cross veins clouded; veins brownish; calyptræ yellowish tinged.

Parafrontals with a few setulæ: ovipositor with fine setulæ on anal plates.

Fore tibia with no posterior bristle; mid femur with 2 or 3 fine bristles on proximal one third of posteroventral surface; mid tibia with 1 antero-dorsal, and 2 posterior bristles; hind femur with 4 or 5 bristles on distal half of anteroventral surface; hind tibia with 2 or 3 anteroventral, and 2 or 3 anterodorsal bristles, and with 2 weaker posterior bristles.

Length, 5 to 5.5 mm.

RECORDS:—

British Columbia, 1 ♂, Hedley, July 7, 1923. (C. B. D. Garrett)

Alberta, 1 ♀, Banff, July 16, 1922. (C. B. D. Garrett); 1 ♂, Banff, June 24, 1925; 1 ♂, July 17, 1925. (Owen Bryant)

Wyoming, 1 ♂, Yellowstone Park, July 25, 1907. (W. Robinson)

Quebec, 1 ♀, Seven Islands, July 20, 1924. (F. W. Waugh)

The species most closely resembles *crassiventris* (p. 292) in that the thorax has four pairs of postsutural dorsocentral bristles, the hind femur has no distinctive bristles on proximal half of posteroventral surface, and the parafacials and cheeks are relatively narrow. The males differ essentially in that in *fuscomarginata* the processes of fifth sternum of abdomen are not conspicuously attenuated at apex, and the inner borders are more or less reddish brown; the abdomen has relatively expansive subtriangular marks, narrowly separated at middle; and the parafrontals have a uniformly developed series of bristles; whereas in *crassiventris* the fifth abdominal sternum is entirely blackish with the apex of each process distinctly attenuated; the abdomen is largely whitish pruinulent with small widely separated dorsal marks, and the cephalic pairs of parafrontal bristles are noticeably stouter developed than those caudad.

In the female of *fuscomarginata* the scutellum has blackish spots at basal angles, the wings have the cross veins conspicuously clouded, and the mid tibia has 1 or 2 anterodorsal bristles,

whereas in *crassiventris* the scutellum is entirely grayish pollinose, the wings have cross veins clear, and the mid tibia has no anterodorsal bristles.

Type and allotype in the Canadian National Collection.

***Limnophora (Spilogona) torreyæ* Johannsen**

Limnophora torreyæ Johannsen, Trans. Amer. Ent. Soc., 1916 XLII No. 756 p. 391.—Johannsen, Ent. News, 1917 XXVIII p. 326.

Limnophora umbrina Stein, Arch. f. Naturgesch., 1920 (1918) Abt. A Heft 9 pp. 48. 54.

Melanocheilia torreyæ Malloch, Canad. Ent., 1921 LIII p. 61.

Spilogona torreyæ Johnson, Occ. Pap. Boston Soc. Nat. Hist., No. VII, 1925 p. 229.—Huckett, Mem. 101 N. Y. (Cornell) Agric. Exp. Station, 1928 (1926), p. 834.

RECORDS:—

9 ♂, 20 ♀, Buttermilk, Ithaca, N. Y., July 18, 1920; 2 ♀, Old Forge, N. Y., Aug. 2, 1905; 2 ♀, Aug. 6, 1905; 1 ♀, July 16, 1905; 1 ♀, July 21, 1905; 1 ♀, Albany, N. Y., June 24, 1920. (M. D. Leonard) 1 ♂, Hempstead, L. I., N. Y., Aug. 21, 1921.

This is a striking species with frons and mesonotum covered with deep seal brown coloration; the pleura, in contrast, are pale gray pruinulent. The legs are very sparsely and weakly bristled. In the male, the head is flattish on top with the facets of the eyes considerably coarser than those below, the parafrontals and cheeks are reduced to lineal dimensions. In the female the proboscis is densely pollinose.

So far, this species is only known to occur in the northern States of eastern America.

***Limnophora (Spilogona) crassiventris* new species**

MALE, head blackish; parafrontals and parafacials silvery pruinulent with dark reflections; cheeks not so densely pruinulent; frontal vitta black with whitish pollen; frontal triangle and proboscis polished; antennæ and palpi black. Thorax blackish, shining; mesonotum blackened, with trace of dorsocentral vitta on presutural area and on postsutural area immediately cephalad of scutellum; notopleural callosity paler; scutellum entirely black. Abdomen densely whitish pruinulent, the ventral surface infuscated: terga 1+2 entirely blackish, terga three and four with paired black marks; tergum five with an indefinite dorsocentral fuscous area; basal

sclerite of hypopygium blackened, subshining. Legs black, subshining; tarsi brownish. Wings smoky; calyptæ whitish, more or less tinged with brownish infuscation; halteres deep yellow.

Eyes separated by a distance not greater than that between posterior ocelli exclusive; frontal vitta small, restricted; parafrontals contiguous; parafrontal bristles stoutly developed, continued in series caudad to apex of frontal triangle; parafacials at base of antennæ narrower than breadth of third antennal segment, restricted ventrad; cheeks scarcely as wide as breadth of third antennal segment, viture along the ventral margin coarsely developed; antennæ small, third segment barely longer than second, arista with short though distinct pubescence towards base.

Thorax with acrosticals setulose, with four pairs of postsutural dorso-central bristles; sternopleural bristles arranged I: 2.

Abdomen conical, noticeably deep dorsoventrad and broadened at base; markings on terga three and four restricted, well defined, and broadly separated, those on tergum three subquadrangular, those on tergum four smaller, and subtriangular; tergum five with a more or less median fuscous area, the paired spots at most very much reduced and confined to caudal margin; cercal plates reddish (upper forceps of genitalia); fifth sternum deeply notched caudad, with numerous coarse setulæ, the processes sharply attenuated at apex into a more or less digitlike extenuation.

Fore tibia with or without a median posterior bristle: mid femur with a series of bristles on posteroventral surface, those on the distal half much weaker and shorter than those on the proximal half; mid tibia with no anterodorsal bristle, and with two posterior bristles: hind femur with 4 or 5 anteroventral bristles on distal half, posteroventral surface with no bristles on proximal half; hind tibia with 2 anteroventral, and 2 anterodorsal bristles, and with 2 weaker posterior bristles.

Wings with veins *R.* 4+5 and *M.* 1+2 divergent towards wing margin.

FEMALE, paler in color than male; head, thorax, and abdomen densely grayish pruinulent; frontal vitta brownish pruinulent; thorax with three narrow brownish vittæ; scutellum entirely grayish: abdomen with two paired brownish marks on terga three and four respectively, and a brownish dorsocentral vitta on tergum five; terga 1+2 almost entirely grayish pruinulent. Wings clear; veins yellowish brown, becoming more yellowish basad; calyptæ whitish.

Parafacials, at base of antennæ, nearly equal in breadth and cheeks in height to width of third antennal segment; the latter one and a half times length of second segment. Abdomen with well defined, restricted, subtriangular spots on terga three and four; terga four and five with a median transverse series of well developed bristles; anal plates of ovipositor with setulose hairs.

Fore tibia with 1 median posterior bristle: mid femur with 4 or 5 bristles on proximal half of posteroventral surface; mid tibia with no anterodorsal bristle, and with 2 posterior bristles: hind femur with 3 bristles on distal

half of anteroventral surface, posteroventral surface with no series of bristles on proximal half; hind tibia with one anteroventral, and 1 or 2 anterodorsal bristles, and with 1 or 2 weaker posterior bristles.

Length, 5 mm.

RECORDS:—

Alaska, 2 ♂, Naknek Lake, Savonoski, July 1919; 1 ♂, 1 ♀, July 27, 1919; 1 ♀, Aug. 1919; 1 ♀, Aug. 1, 1919; 1 ♀, Aug. 14, 1919; 1 ♂, July 28, 1919; 1 ♀, July 31, 1919. (J. S. Hine) 1 ♂, Popoff Island, July 13, 1899; 1 ♂, (?) Muir Inlet, June 12, 1899. (Harriman Exped. '99, T. Kincaid) Washington, 1 ♂, Olympia, no date.

Ontario, 1 ♂, Lake Abitibi, Low Bush, July 23, 1925; 1 ♂, July 30, 1925; 1 ♀, Aug. 2, 1925. (N. K. Bigelow)

Type and allotype in the collection of Professor J. S. Hine, Columbus, Ohio. Paratypes in the collection of the United States National Museum.

This species runs to *zetterstedti* in Ringdahl's key (39), but according to Mr. Ringdahl it is not that species. In certain respects the species resembles *contractifrons*, especially in the characteristic appearance of the male abdomen, but from this species it may be distinguished by the fact that the normal number of postsutural dorsocentral bristles is four pairs and not three, and that the hind femur has no series of posternoventral bristles on proximal half, such as is present in *contractifrons*.

Limnophora (*Spilogona*) *acuticornis* Malloch

Limnophora acuticornis Malloch, Trans. Amer. Ent. Soc., 1920 XLVI No. 802 p. 147.—Friscon, Bull. Ill. Nat. Hist. Surv., 1927 XVI Art. 4 p. 203.

Melanocheilia acuticornis Malloch, Canad. Ent., 1921 LIII p. 64.

Spilogona acuticornis Malloch, Psyche, 1924 XXXI No. 5 p. 202.—Johnson, Occ. Pap. Boston Soc. Nat. Hist., No. VII, 1925 p. 229.—Huckett, Mem. 101 N. Y. (Cornell) Agric. Exp. Station, 1928 (1926) p. 834.

RECORDS:—

Washington, 2 ♂, Olympia, June 22 1920; 1 ♂, Yakima, July 18 1920. (A. L. Melander 1 ♂, Ilwaco, July 7 1918. (A. Spuler)

Idaho, 2 ♀, 1 ♀, viola, no date.; 1 ♀, Craig's Mts., no date.;
1 ♀, Lawyer's Canyon, June 16 1909; 1 ♀, Moscow, June 18
1912. (J. M. Aldrich)

California, 2 ♀, Mount Home Canyon, St. Bernardino Mountains, 1924. (J. M. Aldrich)

Utah, 1 ♂, Emigrant Canyon, Wasatch Mts., 7000 ft. July 8
1911. (J. M. Aldrich)

Nevada, 1 ♀, Wells, June 20 1927. (J. M. Aldrich)

Colorado, 3 ♀, Tennessee Pass, July 24 1917. (J. M. Aldrich)

New York, 1 ♀, Ithaca, May 5 1916; 1 ♀, no date.; 1 ♀, May
23 1920; 1 ♀, May 22 1922; 2 ♀, Buttermilk, Ithaca, July 18
1920.

Quebec, 1 ♂, Hull, Aug. 13 1924; 1 ♂, June 26 1923. (C. H.
Curran)

Nova Scotia, 1 ♀, Truro, July 5 1913. (R. Matheson)

As mentioned by Malloch (31) there is a great similarity between this species and *surda* Zett. In addition to the characters proposed by him for distinguishing the species I find that the males of the above series of specimens differ from those of *surda* in that the cephalic pair of ocellar bristles are more robust, the eyes are more widely separated, and the bristles on the proximal third of posteroventral surface of mid femur, if present, are much weaker than those in *surda*. In the female the fore tibia has no median posterior bristle, and the *m-cu* cross vein is cloudy.

Limnophora (Spilogona) surda (Zetterstedt)

Aricia surda Zetterstedt, Dipt. Scand., 1845 IV p. 1476.—Zetterstedt, Dipt. Scand., 1860 XIV p. 6223.

Limnophora surda Stein, Ent. Nachr. 1892 XVIII No. 20-21 p. 324.—Stroble, Verh. zool.-bot. Gesell. Wien, 1894 (1893) XLIII p. 228.—Stein, Berl. Ent. Zeitschr., 1898 (1897) XLII p. 208.—Stein, Wien. Ent. Zeitg., 1902 XXI Heft 2-3 p. 42.—Aldrich, Misc. Coll. Smithsn. Inst., 1905 XLVI No. 1444 p. 547.—Stein, Katalog Paläark. Dipt., 1907 III p. 674.—Stein, Arch. f. Naturgesch., 1914 (1913) Abt. A Heft 8 p. 27.—Stein, Arch. f. Naturgesch., 1916 (1915) Abt. A Heft 10 p. 110.—Ringdahl, Ent. Tidskr., 1918 XXXIX Nr. 2 p. 164. 178.—Malloch, Trans. Amer. Ent. Soc., 1918 XLIV No. 782 p. 275.—

Stein, Arch. f. Naturgesch., 1920 (1918) Abt. A Heft 9 pp. 47. 58.

Aricia (Limnophora) surda Pandellé, Revue entom. France, 1899 XVIII p. 120.

Limnophora (Spilogona) surda Schnabl and Dziedzicki, Abh. d. Kaiserl. Leop.-Carol. Deutsch. Akadem. d. Naturforsch., 1911 XCV Nr. 2 p. 154.—Collin, Ent. Month. Mag., 1921 ser. 3 VII pp. 163. 215.—Séguy, Faune de France, No. VI 1923 p. 215.—Karl, Tierwelt Deutschlands, 1928 Th. XIII p. 99.—Collin, Trans. Ent. Soc. London, 1930 LXXVIII Pt. 2 p. 279, pls. 17. 26.

Spilogona surda Hockett, Mem. 101 N. Y. (Cornell) Agric. Exp. Station, 1928 (1926) p. 834.

RECORDS:—

British Columbia, 1 ♂, Oliver, May 30 1923; 1 ♀, May 3 1923. (C. B. D. Garrett)

Alberta, 1 ♂, 2 ♀, Bannf, June 21 1922; 1 ♂, June 26 1922. C. B. D. Garrett) 1 ♂, Jasper, July 25 1926. (J. McDunnough)

Manitoba, 1 ♂, Victoria Beach, Aug. 8 1926. (G. S. Brooks)

South Dakota, 1 ♂, Waubay, June 6 1918. (J. M. Aldrich)

Indiana, 1 ♂, Wells Co., May 17 1906. (E. B. Williams)

New York, 1 ♀, Ithaca, 19—.

Specimens of *surda* and *acuticornis* are commonly found together in many collections as either one or the other species, rarely have they been recognized as distinct. It is not unlikely that the species recorded by Stein (60) as *surda* represents a mixed series of these two species, the differences between which have been discovered in connection with the records of *acuticornis*.

Rondani (42) in 1866 designated *surda* Zetterstedt as the type of the genus *Melanochelia*. Pandellé (37) in 1899 recognized that Rondani's designation was founded on an error in identification, and that Rondani's specimens were not *surda* of Zetterstedt but represented a species hitherto not recognized. He renamed the specimens *exsurda*, which became the name of the *Melanochelia*. Meanwhile Coquillett (11) in 1901, evidently con-

struing Rondani's designation literally, listed *surda* Zetterstedt *nec* Rondani as the type of *Melanochelia*, an error which he corrected in a later list (12).

***Limnophora (Spilogona) caroli* Malloch**

Limnophora caroli Malloch, Trans. Amer. Ent. Soc., 1920 XLVI No. 802 p. 154.

Melanochelia caroli Malloch, Canad. Ent. Soc., 1921 LIII pp. 63. 64.

Spilogona caroli Johnson, Occ. Pap. Boston Soc. Nat. Hist., No. VII, 1925 p. 229.—Johnson, Ins. Fauna, Biol. Surv. Mt. Desert Region, 1927 p. 208.—Huckett, Mem. 101 N. Y. (Cornell) Agric. Exp. Station, 1928 (1926) p. 834.

The species is known from Vermont, Maine, New Hampshire, and New York, the type having been captured by Mr. C. W. Johnson on Mt. Ascutney, Vermont, on July 11th 1908.

The male has the eyes nearly as widely separated as in the female, and possesses well developed vertical bristles on head; in addition the hind femur has no series of bristles on proximal half of posteroventral surface. According to these characters the species is associated with *argenteiceps* Malloch, from which it differs in the male in that the pruinescence of the head is grayish drab, and not silvery, the fore tibia has a median posterior bristle, which is absent in *argenteiceps*, and the cheeks are narrower than in that species.

***Limnophora (Spilogona) argenteiceps* (Malloch)**

Spilogona argenteiceps Malloch, Psyche, 1924 XXXI No. 5 p. 200.—Johnson. Occ. Papers Boston Soc. Nat. Hist., No. VII, 1925 p. 229.

The species is known only from New Hampshire; the type, captured by Mr. C. W. Johnson, being labelled Mt. Washington, New Hampshire, at 4000 feet elevation, August 8 —.

The male possesses many of the diagnostic characters common to *caroli*, from which it differs specifically in the pruinescence and shape of the head, and in the armature of the fore tibia as indicated in the key.

***Limnophora (Spilogna) clarans* new species**

MALE, grayish species; parafrontals, parafacials, and cheeks silvery pruinulent with dark reflections; frontal vitta whitish pruinulent; antennae and palpi blackish; third antennal segment grayish tinged; frontal triangle whitish pruinulent; proboscis shining. Thorax with whitish pruinulence on mesonotum, opaque, with no vittæ when viewed from above and in front; when viewed from behind, with dark reflections, subshining; abdomen viewed from behind whitish pruinulent with dark reflections; terga 1+2 largely blackish, terga three and four with black subtriangular marks, tergum five with obscure dark reflections. Legs blackish, knees reddish, pulvilli tinged. Wings and calyptræ hyaline, whitish. Wings with veins pale yellow. Halteres yellow.

Eyes separated by a distance nearly equal to twice breadth of third antennal segment; frontal vitta but little narrowed caudad, distinctly separating profrontals throughout; parafrontals with six pairs of bristles which are widely interspaced, and which are continued in series caudad to level with ocellar callosity; ocellar and vertical bristles strongly developed, bristle-like; parafacials at base of antennae broader than width of third antennal segment, produced beyond a line drawn vertical from vibrissæ, narrowed ventrad; cheeks nearly as high as width of third antennal segment, the latter elongate, about three times as long as wide, apex reaching almost to a level with oral margin.

Thorax with presutural acrosticals setulose, with three pairs of postsutural dorsocentral bristles; sternopleural bristles arranged 1: 2.

Abdomen short, broadly conical; tergum three with paired subtriangular marks which are somewhat truncated cephalad and which are narrowly and obscurely separated at middle of dorsum; tergum four with paired subtriangular marks, smaller and more widely separated than those on tergum three.

Fore tibia with one posterior bristle: mid femur with 3 or 4 weak bristles on proximal half of posteroventral surface; mid tibia with no anterodorsal bristle, with 2 posterior bristles: hind femur with 3 bristles on distal third of anteroventral surface, posteroventral surface bare; hind tibia with 2 anteroventral, and 2 anterodorsal bristles, and with 1 shorter posterior bristle. Tarsi slender, pulvilli robust.

Wings with veins *R*. 4+5 and *M*. 1+2 divergent toward margin of wing, *m-cu* cross vein sinuous.

Length, 4.75 mm.

RECORD:—1 ♂, Orillia, Ontario, June 21 1927. (C. H. Curran)
Type in the Canadian National Collection, Ottawa.

The wings and calyptræ are hyaline and whitish as in *tristiola*, and the facial characteristics somewhat resemble those of the genus *Tetramerinx* in that the antennae are long and pendant,

and the vertical and ocellar bristles are strongly developed; however the arista is long and slender with slight pubescence, and the eyes are not so widely separated as in *Tetramerinx unica*. The abdomen resembles that of *Limnospila albifrons*. Terga 1+2 has a tuft of coarse bristles on the right-hand side of the abdomen only, which undoubtedly is an abnormality.

***Limnophora (Spilogona) cana* new species**

MALE, grayish; parafrontals, parafacials, and cheeks whitish pruinose with dark reflections; frontal vitta and frontal triangle with whitish pruinescence; antennae and palpi black; proboscis polished. Thorax with grayish white pruinescence, with no vittae; abdomen with grayish white pruinescence; terga three and four and five with paired grayish black reflective areas, not intensively marked; basal sclerite of hypopygium and fifth sternum lightly pollinose, subshining; ninth tergum reddish yellow. Legs blackish. Wings clear, veins light brown. Calyptrae whitish; halteres yellow.

Eyes separated by a distance nearly equal to length of third antennal segment; frontal vitta but little narrowed caudad; parafrontals with six or seven pairs of bristles, widely interspaced, continued in series caudad to a level with ocellar callosity; vertical and ocellar bristles strongly developed; parafacials at base of antennae narrower than width of third antennal segment; cheeks about as high as breadth of third antennal segment, the latter about twice as long as broad.

Thorax with presutural acrosticals setulose, with three pairs of postsutural dorsocentral bristles; sternopleural bristles arranged 1:2.

Abdomen with markings subtriangular, those on terga three and four truncated cephalad, subequal; those on tergum five much smaller than those on preceding segments, confined to caudal half of tergum, and not so widely separated.

Fore tibia with no posterior bristle; mid femur with 2 or 3 weak bristles at base of anteroventral surface, with 4 or 5 bristles on proximal half of posteroventral surface; mid tibia with no anterodorsal bristle, with 2 posterior bristles; hind femur with 5 bristles on distal half of anteroventral surface; hind tibia with 1 anteroventral, and 2 anterodorsal bristles. Tarsi long and slender, longer than their respective femur; pulvilli large.

Wings with veins *R*. 4+5 and *M*. 1+2 divergent towards margin of wings. Length, 4.75 mm.

RECORD:—1 ♂, Mt. Adams, Washington, July 24 1921. (A. L. Melander)

Type in collection of the United States National Museum.

This species has the ocellar and vertical bristles in the male stoutly developed. Owing to its pale grayish color it conforms

somewhat in appearance to *clarans*, from which it may be readily separated by the much smaller third antennal segment, and the narrower parafacials. The markings on the abdomen are peculiar in that they appear as lightly imposed grayish refractive areas with no trace of deeper contrasting coloration.

***Limnophora (Spilogona) bisetosa* new species**

MALE, blackish; parafacials and cheeks whitish to brownish black pruinose, with dark reflections; frontal vitta black, with brownish pruinescence; frontal triangle polished; proboscis lightly pollinose; antennae and palpi black. Thorax largely black, subshining, with trace of brownish pruinescence, vittae obscured. Abdomen with grayish white pruinescence, with dark reflections; terga 1+2 largely blackened, terga three, four and five with paired black marks, in addition the area between the tergal marks may be more or less infuscated, tending thereby to obscure the paired identity of such markings; basal sclerite of hypopygium and fifth sternum blackish, subshining. Legs black, pulvilli tinged. Wings infuscated, blackened basad. Calyptrae yellowish tinged, sometimes the upper scale whitish: halteres yellow.

Eyes separated by a distance about equal to breadth of third antennal segment; parafrontal bristles well developed, continued in series caudad to about level with apex of frontal triangle; parafacials at base of antennae scarcely equal to breadth of third antennal segment, narrowed ventrad; cheeks fully equal to breadth of third antennal segment, well maintained caudad; with a number of coarse setulae at base of vibrissae; third antennal segment narrower than second segment, about 1.75 times as long as broad; arista with distinct short pubescence, the basal hairs longer than basal diameter of arista.

Thorax with presutural acrosticals setulose, in closely adjacent series; with three pairs of postsutural dorsocentral bristles; sternopleural bristles arranged 1:1, or 1:2.

Abdomen narrowly conical; tergum three with marks trapezoidal, confined to dorsum; tergum four with markings subtriangular, narrower than those on tergum three and more widely separated; tergum five with obscure narrow triangular marks; fifth sternum deeply notched, processes with two or three fine, weak bristles apicad, the inner margins at apex with a small polished tubercular process.

Fore tibia with at most a fine weak posterior bristle: mid femur with a series of longish setulae on anteroventral surface which become stouter proximad, with 2 stout spinelike bristles on basal third of posteroventral surface, occasionally a third weaker bristle; mid tibia with 1 anterodorsal, and 2 posterior bristles: hind femur with 3 or 4 bristles on distal half of anteroventral surface, posteroventral surface with no series of bristles;

hind tibia with 1 or 2 anteroventral, 2 or 3 anterodorsal bristles, and with the weaker posterior bristles not evident.

Wings with veins *R.* 4+5 and *M.* 1+2 slightly divergent toward wing margin.

FEMALE, paler than male, parafacials and cheeks grayish pruinose; parafrontals with brownish infuscation; frontal vitta brownish pruinose. Thorax grayish pruinose, with three brownish vittæ, and with more or less lateral infuscation on mesonotum; scutellum with brownish marks at basal angles. Abdomen grayish pruinose, with paired brownish marks on terga 1+2, three, and four; tergum five with a brownish dorsocentral vitta. Wings clear, with traces of infuscation along *r-m* and *m-cu* cross veins, and at base of wing membrane.

Parafrontals with numerous setulæ; parafacials at base of antennae as wide as breadth of third antennal segment, narrower ventrad; cheeks higher than breadth of third antennal segment, the latter twice as long as wide; arista short pubescent. Abdomen with paired marks on terga 1+2, terga three and four with subtriangular marks, broadly separated; ovipositor with spinules on anal plates.

Fore tibia with no posterior bristle: mid femur with 2 erect bristles on basal third of posteroventral surface; mid tibia with 5 anterodorsal, and 2 posterior bristles: hind femur with 3 or 4 bristles on distal half of anteroventral surface; hind tibia with 1 or 2 anteroventral, and 2 or 3 anterodorsal bristles, with weaker bristles on posterior surface not evident.

Wings with costal thorns well developed; veins *R.* 4+5 and *M.* 1+2 divergent towards wing margin.

Length, 5-5.75 mm.

Type and allotype in the United States National Museum.

RECORDS:—

Washington, 1 ♂, Seattle, June 17 1917. (H. G. Dyar) 1 ♂.
Lake Chelan, Lucerne, July 29 1919; 1 ♂, Ramparts, Mt.
Rainier, Aug. 1 1922; 1 ♂, Ilwaco, July 1918. (O. H.
Miner) 1 ♂, Lake Stephens, Everett, Aug. 3 1917. (A. L.
Melander) 1 ♂, Ilwaco, July 1917. (J. M. Aldrich) 1 ♂.
Ilwaco, July 12 1918. (A. Spuler)

Oregon, 1 ♂, 1 ♀, Marshfield, June 1927. (J. M. Aldrich)

Idaho, 1 ♂, Mt. Moscow, July 5 1919. (A. L. Melander)

1 ♀, Mt. Moscow, July 25 1920. (R. C. Shannon) 1 ♂,

Mt. Moscow, July 17 1924. (J. M. Aldrich)

In the males of the above series there is a considerable variation in the shape of the abdominal marks, and in the degree of infuscation along dorsum. On tergum three the markings are

typically trapezoidal, and narrowly separated at middle of dorsum; in a few specimens the markings are completely fused across the dorsocentral plane, whilst in others the separation is considerably obscured owing to the degree of infuscation; tergum four has the markings typically subtriangular, being more widely separated than those on tergum three; in certain specimens the triangular marks on tergum three may be more or less truncated at cephalic margin of segment.

The males may be distinguished from those of allied species through the possession of two stout erect bristles on postero-ventral surface of mid femur, the lack of bristles on postero-ventral surface of hind femur, and in having three pairs of post-sutural dorsocentral bristles. The parafacials are comparatively narrow.

The females of *bisetosa* resemble those of *sudra* and *acuticornis* in that the anal plates are armed with spinules, but the former differs from the latter in having the parafacials less prominent in profile, and in having the preapical bristles of scutellum well developed and the setulose hairs on lateral declivities of scutellum lacking.

***Limnophora (Spilogona) bisetosa* var. *pruinella* new variety**

MALE, grayish; parafrontals and parafacials silvery pruinose; cheeks with duller pruinescence; frontal vitta black; antennæ and palpi black; proboscis lightly pollinose. Thorax with a narrow brownish dorsocentral vitta, and with broad, brownish black infuscation laterad of dorsocentral bristles; the narrow space between the dorsocentral bristles and dorsocentral vitta distinctly paler in color, concolorous with humeral and notopleural callosities; scutellum grayish with large brownish areas at basal angles. Abdomen densely grayish pollinose with blackish reflections, with relatively small, paired, blackish marks on terga 1+2, three, and four; tergum five with a brownish dorsocentral vitta; basal sclerite of hypopygium densely grayish pollinose. Legs blackish, pulvilli tinged. Wings brownish tinged, but little if any more densely infuscated basad; *m-cu* cross vein faintly clouded.

Eyes separated by a distance greater than breadth of third antennal segment; frontal vitta distinctly though narrowly separating the parafrontals caudad; parafrontal bristles well developed, continued in series caudad to about level with apex of frontal triangle; parafacials at base of antennæ as wide as breadth of third antennal segment, considerably constricted ventrad; cheeks well maintained caudad, about equal in height to three-quarters length of third antennal segment; arista short pubescent.

Thorax with presutural acrosticals setulose; with three pairs of post-sutural dorsocentral bristles; sternopleural bristles arranged 1:2.

Abdomen cylindrico-conical; tergum three with trapezoidal marks; tergum four with smaller, subtriangular marks, more widely separated than on tergum three; hypopygium, fifth sternum, and chaetotaxy of legs very similar to that of *bispinosa*.

Length, 6 mm.

RECORDS:—

1 ♂, Glenwood, Washington, June 27 1917. (A. L. Melander)

1 ♂, Mt. Home Canyon, S. Bernardino Mts. California, June 8 1924. (J. M. Aldrich)

Type in the United States National Museum.

This variety is evidently a lighter form of the previous species. There are very few, if any, structural differences between the specimens of each series. In *pruinella* the eyes are a little wider apart and the parafacials and cheeks more pronounced than in the males of *bispinosa*. The wings in the male of *pruinella* have only a trace of infuscation; the basal sclerite of hypopygium is densely grayish pollinose, opaque, and the scutellum and abdomen are more largely grayish pruinose, whereas in *bisetosa*, the male has the wings intensively infuscated basad, the basal sclerite of hypopygium, and scutellum are entirely blackish and shining.

Limnophora (Spilogona) rufitibia Stein

Limnophora rufitibia Stein, Arch. f. Naturgesch., 1920 (1918)

Abt. A Heft 9 pp. 46. 52.

Spilogona rufitibia Hockett, Mem. 101 N. Y. (Cornell) Agric. Exp. Station, 1928 (1926) p. 834.

RECORDS:—

Idaho, 1 ♂, Mt. Moscow, July 25 1920. (R. C. Shannon) 1 ♂,

Mt. Moscow, July 8 1911; 1 ♂, July 6 1912. (J. M. Aldrich)

1 ♂, Lake Waha, June 9 1916. (A. L. Melander)

New York, 2 ♀, McLean, Sept. 11 1920: 1 ♀, Montezuma

Marshes, Cayuga, July 1 1920: 1 ♂, Hempstead, Long

Island, June 5 1921: 1 ♂, 1 ♀, Lakeville, Long Island, May

22 1921: 2 ♀, Valley Stream, Long Island, April 27 1921.

Rhode Island, 1 ♂, Button Woods, June 22.

New Hampshire, 1 ♀, White Mountains, no date. (Morrison)

Nova Scotia, 1 ♀, Truro, July 26 1913. (R. Matheson)

I find that this species is frequently mistaken for *suspecta* Malloch in many collections, from which it may be readily separated in both sexes by the possession of three fine setulose hairs on dorsal margin of lateral declivities of scutellum adjacent the apical bristles. These are lacking in *suspecta*.

In the male the species may be further recognized by the following characters, a) parafrontal bristles not continued in series to a level approximating that of anterior ocellus, b) processes of fifth sternum are truncated at apex, the border of which is glossy and shining, c) the abdominal marks are poorly defined, being more or less reflective areas as the abdomen is shifted in its position and relation to the light.

In the case of *suspecta* the parafrontal bristles are continued in a series caudad to a level with frontal triangle, the processes of fifth sternum are not truncated at apex, the margin being more or less broadly rounded with a slight angular outline on inner margin, the abdominal marks are distinct and are readily recognized.

In the female of *rufitibia* the mid tibia has no anterodorsal bristle, and the fore tibia has no median posterior bristle; whereas in the female of *suspecta* both these bristles are present.

Limnophora (*Spilogona*) *suspecta* Malloch

Limnophora suspecta Malloch, Trans. Amer. Ent. Soc., 1920 XLVI No. 802 p. 154.

Melanocheilia suspecta Malloch, Canad. Ent., 1921 LIII p. 63.

Spilogona suspecta Johnson, Occ. Pap. Boston Soc. Nat. History, No. VII, p. 229.

RECORDS:—

Nova Scotia, 1 ♂, Kentville, July 28 1924; 1 ♀, Digby, Aug. 21 1913. (R. P. Gorham) 1 ♀, Bridgetown, Sept. 2 1912. (G. E. Saunders) 1 ♀, West River, July 24 1913. (R. Matheson)

New Brunswick, 1 ♀, Fredericton, Aug. 3 1913; 1 ♂, June 21 1914. (J. D. Tothill) 1 ♂, Red Rapids, July 23 1913. (R. P. Gorham)

Quebec, 1 ♂, Kazubazua, July 20 1927. (G. S. Walley)

Maine, 1 ♂, Capens, July 21 —: 1 ♂, Mt. Katahdin, summit elev. 5215 ft. Aug. 19 1902.

New Hampshire, 2 ♀, Mt. Washington, no date.; 1 ♀, White Mountains, no date. (Morrison)

British Columbia, 2 ♂, Carbonate Columbia River, July 7-12 1908, alt. 2600 ft. (J. C. Bradley)

This species closely resembles *rufitibia*, with which it has already been compared.

***Limnophora (Spilogona) fimbriata* new species**

MALE, blackish; parafrontals and parafacials whitish pruinose, with dark reflections; cheeks drab, grayish, not so highly pruinose; frontal vitta black with whitish pollen; antennae and palpi black; frontal triangle and proboscis polished. Thorax blackish, subshining, with trace of darker dorsocentral and sublateral lines, paler grayish on cephalic half of presutural area and laterad on humeral and notopleural callosities; scutellum entirely blackish. Abdomen with dense grayish pruinoscence, and darker reflections; terga 1+2 largely blackish, terga three and four each with a pair of blackish marks, tergum five with a brownish fuscous dorsocentral vitta; basal sclerites of hypopygium lightly pollinose. Legs black, pulvilli brownish tinged. Wings hyaline, veins brownish black. Calyptrae whitish, the under scale with distinctly yellowish margin; halteres yellow.

Eyes separated by a distance slightly greater than diameter of anterior ocellus; frontal vitta interrupted caudad by the contiguity of parafrontals; parafrontal bristles well developed, the series extending caudad to a level with narrowest part of frons; parafrontals at base of antennae scarcely equal to breadth of third antennal segment; cheeks, in height, fully equal to breadth of third antennal segment, the latter slightly longer than second segment; arista minutely pubescent.

Thorax with presutural acrosticals setulose, in two more or less irregular series; with three pairs of postsutural dorsocentral bristles; scutellum with a few setulose hairs on dorsal margin of lateral declivities adjacent the apical bristles; sternopleural bristles arranged, 1: 2.

Abdomen conical, markings on terga three and four broadly separated, restricted to dorsum, well defined, those on tergum three trapezoidal, those on tergum four subtriangular; tergum five with ill defined dorsocentral markings; fifth sternum broadly emarginate, with numerous fine longish bristles.

Fore tibia with or without a posterior bristle, and with a weak apical posteroventral bristle: mid femur with a series of 5 or 6 bristles on proximal half of posteroventral surface; mid tibia with no anterodorsal, and with 2 posterior bristles: hind femur with a series of 3 or 4 bristles on distal half of anteroventral surface, and with a series of longer, finer bristles on proximal half, the latter increasing in length basad, with a

similar series of long fine bristles on proximal half of posteroventral surface; hind tibia with 1 or 2 anteroventral, and 1 or 2 anterodorsal bristles, the posterior surface with 1 or 2 setulose bristles.

Wings with veins *R.* 4+5 and *M.* 1+2 slightly divergent towards wing margin.

Length, 5 mm.

RECORDS:—

2 ♂, Cranbrook, British Columbia, June 21 1926. (A. A. Dennys)

1 ♂, Waterton, Alberta, July 14 1923. (H. L. Seamans)

Type in the Canadian National Collection, Ottawa.

The species closely resembles *baltica* Ringdahl in that the hind femur in male has noticeably long fine bristles on proximal half of posteroventral surface, and the scutellum has the fine setulose hairs on dorsal margin of lateral declivities of scutellum adjacent the apical bristles. However in *fimbriata* the bristles on proximal half of anteroventral surface of hind femur are equally long and fine, longer than those on distal half; whereas in *baltica* these bristles are much shorter than those on the posteroventral surface, and than those on distal half of anteroventral surface of hind femur.

The specimen from Waterton was sent to Mr. Ringdahl for examination, who very kindly loaned me a Swedish specimen of *baltica* for further study.

Limnophora (Spilogona) pluvialis new species

MALE, grayish black; parafrontals and parafacials with whitish pruinescence, and with dark reflections; cheeks with brownish pruinescence; frontal vitta black, viewed from below with brownish pollen; frontal triangle polished; proboscis lightly pollinose, subshining; antennæ and palpi black. Thorax with mesonotum largely grayish black, with trace of brownish pruinescence, humeral and notopleural callosities pale gray, vittæ obscured; scutellum entirely blackish; pleura blackened. Abdomen largely blackish, terga 1+2 entirely blackish, tergum three similar to terga 1+2, with a trace of grayish pruinescence at cephalolateral angles and along the dorso-central plane; tergum four more grayish pruinulent than tergum three, the blackish marks smaller and more distinctly separated; tergum five with no definite markings, largely blackish, infuscated; basal sclerite of hypopygium with trace of pruinescence, subshining. Legs brownish black, pulvilli tinged. Wings lightly infuscated, more densely so basad; calyptræ tinged; halteres deep yellow, with trace of purple.

Eyes separated by a distance slightly less than breadth of third antennal segment; frontal vitta constricted to lineal dimensions caudad, separating the parafrontals; parafrontal bristles continued in series caudad to a level with narrowest constriction between the eyes; parafacials at base of antennæ nearly equal to breadth of third antennal segment; cheeks in height about equal to three-quarters length of third antennal segment, somewhat restricted throughout caudal half by the upward curvature of the ventral margin of head capsule.

Thorax with presutural acrosticals setulose, in two closely adjacent series, with three pairs of postsutural dorsocentral bristles; sternopleural bristles arranged, 1:1. Scutellum with setulose hairs on dorsal margin of lateral declivities adjacent apical bristles.

Abdomen narrowly conical, terga three and four with more or less paired trapezoidal marks which are broader than long, occasionally such markings on either tergum may be fused across the dorsocentral plane; sternum five deeply notched, with 1 or 2 longish weak bristles at apex of processes.

Fore tibia with or without a fine weak posterior bristle: mid femur with a series of short weak bristles on proximal half of anteroventral surface, and with a series of longish bristles on proximal two-thirds of posteroventral surface; mid tibia with or without an anterodorsal bristle, and with 2 or 3 longish posterior bristles: hind femur with 4 or 5 longish bristles on distal half, and with 5 or 6 much weaker and shorter bristles on proximal half of anteroventral surface, with a series of short bristles on proximal half of posteroventral surface; hind tibia with 1 to 3 anteroventral, and with 2 or 3 anterodorsal bristles, with or without 1 or 2 weaker posterior bristles.

Wings with a series of prominent costal setulæ proximad of costal thorn; veins *R.* 4+5 and *M.* 1+2 divergent towards wing margin, *m-cu* cross vein erect.

FEMALE, similar to male; parafrontals, parafacials, and cheeks brownish gray pruinose, more densely so on parafrontals; frontal vitta brownish pollinose; thorax with mesonotum, scutellum, and pleura more brownish infuscated than in male; abdomen subshining, with large brownish markings on terga 1+2, three, and four; tergum five with trace of brownish dorso-central vitta. Wings clear; veins brownish.

Parafrontals with numerous setulæ; parafacials, at base of antennæ, broader and cheeks higher than width of third antennal segment; sternopleural bristles arranged, 1:2. Abdomen with large, paired subtriangular marks on terga three and four, the outlines of which are poorly defined; abdominal bristles well developed; ovipositor with fine setulæ on anal plates.

Fore tibia with or without a posterior bristle: mid femur with a series of 4 or 5 bristles on proximal half of posteroventral surface; mid tibia with 1 anterodorsal, and 2 posterior bristles: hind femur with 5 or 6 bristles on distal half of anteroventral surface, posteroventral surface with a series of short weak bristles on proximal half; hind tibia as in male.

Wings with a series of robust costal setulæ proximad of costal thorns.
Length, 4.5 mm.

RECORDS:—

1 ♂, 1 ♀, Paradise Park, Mt. Rainier, Washington, July 27 1922; 2 ♂, 2 ♀, August 1917; 1 ♂, 1 ♀, Crystal Mountain, Mt. Rainier, Washington, Aug. 3 1922; 1 ♂, 1 ♀, Sluiskin, Mt. Rainier, Washington, July 28 1922; 1 ♂, Ind. Henry, Mt. Rainier, Washington, Aug. 2 1922. (A. L. Melander)

Type and allotype in the United States National Museum. Paratypes in Canadian National Collection.

This species is not readily comparable to others in the genus. The males agree with those of *crepusculenta*, *comata*, and others in having the thoracic pleura blackened, darker in coloration than mesonotum. On the other hand the thorax in male and female has three pairs of postsutural dorsocentral bristles, and the halteres are yellow; in addition the scutellum has fine setulose hairs on dorsal margin of lateral declivities adjacent apical bristles, and the costal setulæ are prominently developed proximad. There is a considerable degree of variation in the intensity of abdominal infuscation in the male making it a difficult matter to recognize any definite marks: in the female there is a considerable variation in the degree of development of the setæ on the posteroventral surface of hind femur, the interpretation of which is none too easy owing to their setulose character in most specimens.

Limnophora (*Spilogona*) *baltica* Ringdahl

Limnophora fumipennis Stein not Zetterstedt, Arch. f. Naturgesch., 1916 (1915) Abt. A Heft p. 101.—Stein, Arch. f. Naturgesch., 1920 (1918) Abt. A Heft 9 p. 56.

Limnophora baltica Ringdahl, Ent. Tidskr., 1918 XXXIX Nr. 2 p. 165.

Limnophora (*Spilogona*) *baltica* Karl, Tierwelt Deutschlands, 1928 Th. XIII p. 99.—Collin, Trans. Ent. Soc. London, 1930 LXXVIII Pt. 2 p. 277, pls. 17, 27.

Male blackish; parafrontals and parafacials silvery pruinulent; cheeks with brownish pruinescence; antennæ and palpi black. Mesonotum largely blackened, with trace of brownish

pruinescence and darker lines along the dorsocentral and sub-lateral planes; humeral and notopleural callosities pale grayish. Abdomen grayish pruinescent, terga 1 + 2 largely blackish, terga three and four with large paired black marks, tergum five with a pair of narrow blackish marks between which the surface is brownish infuscated; basal sclerite of hypopygium grayish pollinose. Legs black. Upper calyptra whitish, under calyptra brownish tinged. Halteres yellow.

Eyes separated by a distance about equal to that between posterior ocelli exclusive; parafrontals contiguous; parafrontal bristles well developed, continued in series caudad to level with frontal triangle; parafacials barely equal to width of third antennal segment, narrowed ventrad; cheeks fully as high as breadth of third antennal segment, with a series of upturned setulose bristles along ventral border.

Thorax with presutural acrosticals in two adjacent series, comprising four irregularly paired weak bristles and one or two accessory setulae; the presutural area between the dorsocentral bristles significantly devoid of setulae, with one or two setulae adjacent the dorsocentral bristles and the transverse suture; acrosticals well developed, stouter than the adjacent setulae; scutellum with two longish setulae on dorsal margin of lateral declivities adjacent the apical bristles; mesopleural series of bristles with no intermediate predorsal bristle; with three pairs of postsutural dorsocentral bristles.

Abdomen similar to that of *alticola* Malloch, conical and deep; abdominal marks confined to dorsum; tergum three with a pair of quadrilateral marks, each as broad along cephalic as along caudal margin, the inner margins slightly convergent cephalad; tergum four with smaller subtriangular marks, the inner margins convergent caudad; tergum five with marks reduced to two narrow dorsal strips, which are confined to caudal half of surface; fifth sternum with broad, flat, processes, each clothed with a few fine bristles.

Fore tibia with a weak apical posteroventral bristle, and with no posterior bristle; mid femur with a series of 5 or 6 weak bristles on proximal half of anteroventral surface, and with a series of 7 or 8 bristles on proximal half of posteroventral sur-

face; mid tibia with 2 posterior bristles: hind femur with a complete series of anteroventral bristles, of which 4 or 5 on distal half are strongly developed, and 6 to 8 on proximal half are fine and shorter, increasing in length proximad, posteroventral surface with a series of long fine bristles on proximal half, the longest of which exceed in length the breadth of femur where situated; hind tibia with 1 or 2 anteroventral, and 2 anterodorsal bristles, the setulose bristles on posterior surface obscure, apical anterodorsal bristle weakly developed, apical posterodorsal bristle setulose.

Wings smoky, more densely infuscated basad; *m-cu* cross vein almost straight; veins *R.* 4+5 and *M.* 1+2 slightly divergent distad.

Length, 5 mm.

This species was recorded by Stein (60) from Idaho as *fumipennis* Zetterstedt. In a footnote Stein mentions that in the opinion of Ringdahl the species thus named was not conspecific with that of Zetterstedt. Earlier, Ringdahl (39) had proposed the name *baltica* for Stein's species, and had placed *fumipennis* as a synonym of *contractifrons* Zetterstedt. I have not seen Stein's North American specimens of this species. Mr. Ringdahl has very kindly furnished me with a Swedish specimen of *baltica*, which has formed the basis for this study.

The male of this species resembles most closely those of *fimbriata* and *reflecta* (p. 208). From the former species it may be separated by the lack of long fine bristles on proximal half of anteroventral surface of hind femur, and from the latter by the presence of a series of longish fine bristles on proximal half of posteroventral surface of hind femur.

Limnophora (*Spilogona*) *gibsoni* Malloch

Limnophora gibsoni Malloch, Trans. Amer. Ent. Soc., 1920 XLVI No. 802 p. 152.

Melanochelia gibsoni Malloch, Canad. Ent., 1921 LIII pp. 62. 64.

RECORDS:—

New Brunswick, 1 ♂, St. Leonards, June 30 1914. (F. M. McKenzie)

New Hampshire, 1 ♂, near summit of Mt. Washington, July 13, 1895. (Geo. Dimmock) 1 ♀, base of Mt. Washington, 2600 ft. Aug. 27, 1914. (C. H. T. Townsend) 1 ♀, Mt. Washington, no date. (Mrs. Slosson)

New York, 1 ♀, Whiteface Mt. Adirondacks, 3800 ft. July 4.—(J. M. Aldrich) 1 ♀, Cooperstown, June 22, 1921.

Alberta, 1 ♀, Waterton, July 2, 1924. (H. L. Seamans)

The species superficially resembles *magnipunctata* Malloch, especially in the male sex in that the wings are more or less infuscated, being blackened basad. It can however be readily separated from this species in that the hind femur has a few bristles on the median third of posteroventral surface, and the abdominal markings are restricted to the dorsum; whereas in the case of *magnipunctata* the hind femur has no well developed bristles on posteroventral surface, and the abdominal markings are expansive. In these respects the male resembles that of *alticola*, in which species the processes of the fifth abdominal sternum are broad and rounded apicad, the fore tibia has usually a posterior bristle, and the wings are at most lightly infuscated basad; whereas in *gibsoni* the processes of fifth abdominal sternum are narrowly tapering apicad, and the fore tibia has no posterior bristle.

The female of *gibsoni* has two to four weak bristles on median third of posteroventral surface of hind femur as in male, one or two ventral bristles on the mid tibia, the calyptræ are intensively yellowish, and the eyes are less broadly separated than usual, the distance at middle of frons being about equal to that separating the anterior and posterior sternopleural bristles.

Limnophora* (*Spilogona*) *contractifrons* var. *fumipennis
(Zetterstedt)

Aricia fumipennis Zetterstedt, Dipt. Scand., 1845 IV p. 1465.

Limnophora fumipennis Stein, Katalog Paläark. Dipt., 1907 III p. 671.

Limnophora contractifrons Ringdahl in part, Ent. Tidskr., 1918 XXXIX p. 159.

RECORDS:—

Alaska, 1 ♂, 1 ♀, Naknek Lake, Savonoski, July 27, 1919; 1 ♀, July 31, 1919; 2 ♀, July 1919; 1 ♀ August 1, 1919; 1 ♀, Aug.

14, 1919; 2 ♀, Snug Harbor, June 8, 1919. (J. S. Hine)
1 ♂, Hurricane, July 15, 1921; 1 ♂, Kukak Bay, July 4,
1899. (T. Kincaid)

Labrador, 1 ♂, 1 ♀, Ungava Bay, July 22. (L. M. Turner)
New Hampshire, 1 ♂, White Mts., no date. (Morrison)

The male specimens before me of this subspecies may be readily recognized by the characteristic shape of the abdomen, which is uniformly deep from base to apex and is noticeably compressed laterad. In this respect they are typical of *contractifrons*, from which they vary in that the wings are not hyaline but are tinged throughout with brownish infuscation. Collin (6a) has considered the species a synonym of *arctica* Zetterstedt.

Limnophora (Spilogona) alticola Malloch

Limnophora alticola Malloch, Trans. Amer. Ent. Soc., 1920 XLVI
No. 802 p. 153.

Melanochelia alticola Malloch, Canad. Ent., 1921 LIII p. 64.

Spilogona alticola Malloch, Psyche, 1924 XXXI No. 5, p. 201.—

Johnson, Occ. Papers Boston Soc. Nat. Hist., No. VII 1925
p. 229.—Johnson, Insect Fauna, Biol. Surv. Mt. Desert Region,
1927 p. 208.—Huckett, Mem. 101 N. Y. (Cornell) Agric. Exp.
Station, 1928 (1926) p. 834.

RECORDS:—

Quebec, 1 ♂, Bradore Bay, July 19, 1929; 1 ♂, July 21, 1929;
1 ♂, 2 ♀, July 17, 1929; 4 ♂, 3 ♀, July 27, 1929; 2 ♀, Mutton
Bay, July 11, 1929; 1 ♂, Bonne Esperance, July 14, 1929.
(W. J. Brown) 1 ♀, Roberval, July 28, 1915. (G. Beaulieu)
1 ♀, Meach Lake, June 21, 1916.

New Brunswick, 1 ♀, Fredericton, July 17, 1912; 1 ♀, June 21,
1914. (J. D. Tothill)

Maine, 1 ♂, Bar Harbor, June 13, 1921. (C. W. Johnson)

New Hampshire, 1 ♂, Mt. Washington, 3000 ft. July 8, 1919.

Vermont, 1 ♀, Mt. Equinox, June 5, 1910.

Massachusetts, 1 ♂, Mt. Greylock, June 14, 1906.

Ontario, 1 ♂, 1 ♀, Sand Lake, June 30, 1926. (F. P. Ide) 1 ♂,
Orillia, June 16, 1927. (C. H. Curran) 1 ♂, Waubamie,
June 14, 1914; 1 ♂, June 14, 1915. (H. S. Parish) 2 ♂,

Waubamic, Parry Sound, June 8, 1915. (J. M. Aldrich)
1 ♀, Lake Abitibi, Low Bush, July 14, 1925. (N. K. Bigelow)

New York, 10 ♂, Whiteface Mt. Adirondacks, 3800 ft. July 4, 1921. (J. M. Aldrich) 1 ♀, Ringwood, Ithaca, June 26, 1920; 1 ♀, Cranberry Lake, July 2, 1917. (C. J. Drake)

Alberta, 1 ♂, Banff, June 20, 1922. (C. B. D. Garrett)

This species agrees very closely with the references by authors to *contractifrons*. Specimens sent to European workers have invariably been returned with a note expressing its similarity to *contractifrons*. I find however, as indicated by Malloch (31), that there are significant differences in the structure of the parts composing the axial system of the male genitalia of *alticola* and *fumipennis*, which cause me to doubt whether this species is as closely related to *contractifrons* as its external appearance would suggest.

The species *contractifrons* has been reported from Greenland by Staeger (53) and Lundbeck (22), and is listed in the catalogues of North American diptera by Osten Sacken (36) and Aldrich (1). I am unable to verify these records from North America, partly owing to the lack of authenticated specimens of *contractifrons*.

***Limnophora (Spilogona) pulchra* new species**

MALE, parafrontals and parafacials silvery pruinescent; cheeks whitish pruinescent, with dark reflections; frontal vitta, viewed from below with whitish pollen; frontal triangle polished; proboscis lightly pollinose, subshining; antennæ deep black; palpi blackish. Thorax grayish pruinescent, the presutural area with a brownish dorsocentral vitta, the sublaterals more indistinct and narrower than the median vitta, the postsutural area with brownish infuscation between the dorsocentral bristles and laterad of intralar bristles; scutellum blackish, dorsal half of mesopleura blackish infuscated. Abdomen with grayish pruinescence, all terga with paired blackish marks, those on terga 1+2 and on five fused in part across the dorso-central plane; basal sclerite of hypopygium blackish, subshining, with trace of grayish pruinescence. Legs blackish; pulvilli tinged. Wings with trace of infuscation, but little darker basad; veins brownish. Calyptæ whitish; halteres yellow.

Eyes separated by a distance slightly greater than maximum breadth of third antennal segment; frontal vitta narrowed caudad, distinctly separating the parafrontals; the latter with six pairs of bristles, which are con-

tinued in series caudad to about a level with apex of frontal triangle, the caudal three pairs of bristles weaker and shorter than the cephalic three pairs of series; parafacials at base of antennæ about equal in breadth to average width of third antennal segment; cheeks well maintained caudad, in height fully equal to three quarters length of third antennal segment, the latter tapering distad; arista slightly swollen at base, pubescence on proximal half about equal to diameter at base of arista.

Thorax with presutural arosticals setulose; with three pairs of post-sutural dorsocentral bristles; sternopleural bristles arranged, 1:2.

Abdomen cylindrical, with markings confined to dorsum of each tergum; tergum three with marks subquadrate, longer than broad; tergum four with subtriangular marks; tergum five with subtriangular marks which are not so well defined as those on tergum four, the inner margins tending to approximate caudad; sternum five with deep notch, the processes with a number of long black bristles apicad, the inner border clothed with numerous fine setulæ.

Fore tibia with no posterior bristles: mid femur with 1 bristle at base, the antero- and posteroventral surfaces with a series of fine setulæ; mid tibia with 1 anterior and 3 posterior bristles: hind femur with 4 or 5 bristles on distal half of anteroventral surface, with no series of weak bristles on proximal half of posteroventral surface; hind tibia with 3 or 4 anteroventral, and 1 or 2 anterodorsal bristles, and with 1 or 2 weaker posterior bristles. Tarsi long and slender, mid tarsi as long as hind tarsi, fore tarsi shorter than mid tarsi.

Wings with *R.* 4+5 and *M.* 1+2 veins slightly divergent towards wing margin.

Length, 5.5 mm.

RECORD:—

1 ♂, Fairbanks, Alaska, July 1, 1921. (J. M. Aldrich)

Type in the United States National Museum.

The species may be distinguished in the male sex by the unusual presence of several well developed bristles at apex of processes of fifth abdominal sternum, and by the lack of bristles on posteroventral surface of mid femur.

Limnophora (*Spilogona*) *anthrax* Bigot

Limnophora anthrax Bigot, Ann. Soc. Ent. France, 1885 (1884) ser. 6 V p. 274. Van der Wulp, Biolog. Centr.-Americana, 1896 II p. 347.—Aldrich, Misc. Coll. Smithsn. Inst., 1905 XLVI No. 1444 p. 546.—Stein, Arch. f. Naturgesch., 1919 (1917) Abt. A Heft I p. 133.

Limnophora squamosa Stein, Arch. f. Naturgesch., 1920 (1918)
Abt. A Heft 9 pp. 46. 53.

Melanocheilia anthrax Malloch, Canad. Ent., 1921 LIII p. 63.

RECORDS:—

Alaska, 1 ♂, Seward, July 26, 1921; 1 ♂, Anchorage, July 21, 1921; 1 ♂, July 20, 1921. (J. M. Aldrich) 1 ♂, Yakutat, June 21, 1899. (Harriman Alaska Exped., T. Kincaid)

British Columbia, 1 ♂, 1 ♀, Revelstoke Mountain, elev. 6000 ft. Aug. 12, 1923. (P. N. Vroom)

Alberta, 1 ♂, Laggan, July 22, 1901; 1 ♂, Waterton, July 12, 1923. (H. L. Seamans) 1 ♂, Waterton Lakes, June 22, 1923. (J. McDunnough)

Oregon, 1 ♂, Mt. Hood, July 29, 1921 (W. Downes)

Washington, 1 ♂, Mt. Adams, July 24, 1921; 1 ♂, Mt. Rainier, Van Trump Creek, Sept. 1, 1917; 2 ♂, July 21, 1922; 4 ♂, 3 ♀, Eagle Park, Mt. Rainier, July 19, 1922; 2 ♂, 1 ♀, Aug. 25, 1921; 10 ♂, 7 ♀, Fairfax Trail, Mt. Rainier, Aug. 9, 1922; 1 ♂, Sluiskin, Mt. Rainier, July 28, 1922; 1 ♂, Hanson Camp, Mt. Rainier, July 31, 1922; 2 ♂, Paradise Park, Mt. Rainier, Aug. 1917. (A. L. Melander)

Idaho, 1 ♂, Cavanaugh B., Priest Lake, Aug. 18, 1919; 2 ♂, Lookout Mt., Priest Lake, Aug. 20, 1919. (A. L. Melander)

Montana, 1 ♂, Lake Macdonald, Glacier Park, Aug. 14, 1916. (A. L. Melander)

The species was described by Bigot from the male sex only, and from material captured in Mexico. The male may be readily recognized in that the calyptræ are intensively infuscated throughout, as in *narina* and *concolor*. The latter however have usually four pairs of postsutural dorsocentral bristles, whereas in *anthrax* the usual number is three. The female of *anthrax* closely resembles that of *magnipunctata* Malloch, from which it is not readily separated. In *anthrax* the calyptræ of the female are intensively yellowish, and the parafacials are comparatively narrow when viewed in profile.

Limnophora (*Spilogona*) *magnipunctata* Malloch

Limnophora magnipunctata Malloch, Proc. Cal. Acad. Sci., 1919 ser. 4 IX No. 11 p. 301.

Limnophora fumosa Stein, Arch. f. Naturgesch., 1920 (1918)
Abt. A Heft 9 pp. 47. 48.

Melanochelia magnipunctata Malloch, Canad. Ent., 1921 LIII
p. 64.

Spilogona magnipunctata Hockett, Mem. 101 N. Y. (Cornell)
Agric. Exp. Station, 1928 (1926) p. 834.

RECORDS:—

- 1 ♂, 1 ♀, Katmai, July 1917; 1 ♀, Aug. 1917. (J. S. Hine)
1 ♂, Kukak Bay, July 4, 1899; 1 ♂, Popoff Island, July 8,
1899; 1 ♂, July 10, 1899; 1 ♀, July 11, 1899; 1 ♀, July 13,
1899; 1 ♀, July 14, 1899; 1 ♂, Kadiak Island, July 20, 1899;
1 ♂, July 30, 1899. (Harriman Alaska Exped., T. Kincaid)
British Columbia, 1 ♂, 1 ♀, Mt. Cheam, Aug. 5, 1903; 1 ♀,
Minniel, July 26, 1925. (E. R. Buckell) 1 ♀, Hedley, Aug.
29, 1923. (C. B. D. Garrett) 2 ♂, 2 ♀, Carbonate to Prairie
Hills, July 12–18, 1908; 2 ♀, Goldstream to Downie Creek,
Selkirk Mts., Aug. 7–11, 1905. (J. C. Bradley)
Alberta, 1 ♂, 1 ♀, Waterton, July 1, 1924; 2 ♂, June 30, 1924;
1 ♂, July 11, 1923; 1 ♀, Aug. 13, 1922. (H. L. Seamans)
Washington, 1 ♂, Seattle, May 25, 1919. (J. S. Hine)
California, 3 ♂, Alta Meadow, Seq. Nat. Park, July 19, 1907,
elev. 9000 ft. (J. C. Bradley)

The above series of specimens exhibit a wide degree of variation in size, coloration of calyptræ, and width of parafacials. The mid tibiæ in some specimens have a posteroventral bristle, which in others is absent. I have been unable to recognize any external structure whereby the males of *magnipunctata* differ from those of *anthrax*, and in the female the two species are still more difficult to separate.

***Limnophora (Spilogona) reflecta* new species**

MALE, with parafrontals, parafacials, and cheeks brownish pruinose, with dark reflections; frontal vitta reddish cephalad; frontal triangle polished; proboscis lightly pollinose, subshining; antennæ and palpi black. Thorax viewed from above and behind blackish, subshining, vittæ obscured, with trace of brownish pruinescence. Abdomen densely grayish brown pruinose; terga 1+2 largely brownish black; terga three and four with paired blackish marks; tergum five with brownish pruinescence and trace of darker markings caudad; basal sclerite of hypopygium lightly pollinose,

subshining. Legs blackish, pulvilli infuscated. Wings clear, with but little trace of infuscation basad; veins blackish brown; halteres light yellow.

Head with eyes separated by a distance slightly less than breadth of third antennal segment; frontal vitta reduced to lineal dimensions caudad, perceptibly separating the parafrontals; parafrontal bristles well developed, continued in series caudad to a level approaching that at narrowest distance between the eyes; parafacials at base of antennæ slightly narrower than breadth of third antennal segment, considerably restricted ventrad; cheeks broad, well maintained caudad, in height fully equal to breadth of third antennal segment; arista short pubescent, the basal hairs about as long as diameter of arista at base.

Thorax with presutural acrosticals setulose, with three pairs of post-sutural dorsocentral bristles; scutellum with fine hairs on dorsal margin of lateral declivities adjacent the apical bristles; sternopleural bristles arranged, 1: 1.

Abdomen cylindrico-conical, viewed from above and behind terga three and four with markings restricted to dorsum, on the former segment the marks are subquadrate, on the latter subtriangular, smaller, and more widely spaced apart; tergum five with small, more or less obscure marks caudad; sterna three and four with a series of fine bristles along lateral margins; sternum five with fine setulæ and a few fine bristles at apex of processes, the inner margin with a small polished tubercular process at apex.

Fore tibia with no median posterior bristle; mid femur with a series of longish setulæ along anteroventral surface, with a series of bristles on proximal half of posteroventral surface; mid tibia with 2 posterior bristles; hind femur with 4 bristles on distal half of anteroventral surface, posteroventral surface with no bristles; hind tibia with 1 or 2 anteroventral, and 2 anterodorsal bristles, and weaker bristles on posterior surface not evident.

Wings with veins *R.* 4+5 and *M.* 1+2 divergent towards wing margin; *m-cu* cross vein oblique.

FEMALE, paler than male; parafrontals, parafacials, and cheeks grayish pruinose, the parafrontals largely brownish pruinose; frontal triangle brownish pollinose; proboscis pollinose. Thorax viewed from above and in front densely grayish pruinose, with brownish dorsocentral vitta; macrochaetae set in brownish spots; scutellum entirely grayish. Abdomen densely grayish pruinose with paired brownish marks on terga 1+2, three, and four; tergum five with brownish dorsocentral vitta. Legs blackish, the coxæ and femora densely grayish pollinose. Wings clear, veins yellowish brown; calyptæ whitish. Halteres light yellow.

Parafrontals with a few setulæ; parafacials at base of antennæ about as wide as breadth of third antennal segment; cheeks in height fully as wide as breadth of third antennal segment. Thorax with sternopleural bristles arranged, 1: 2, the ventral bristle of caudal pair short and much weaker developed than dorsal bristle. Abdomen with paired subtriangular

marks on terga 1+2, three, and four; ovipositor with setulose hairs on anal plates.

Fore tibia with no median posterior bristle; mid femur with only a bristle at base of ventral surface; mid tibia with 2 or 3 posterior bristles; hind femur with 3 or 4 bristles on distal half of anteroventral surface; hind tibia with 1 anteroventral, and 2 anterodorsal bristles, and with 1 weaker posterior bristle.

Wings with costal thorns strongly developed; veins *R.* 4+5 and *M.* 1+2 divergent towards wing margin; *m-cu* cross vein sinuate.

Length, 5 mm.

RECORD:—

1 ♂, Bozeman, Montana, June 14, 1916; 1 ♂, June 15, 1916;

1 ♀, June 30, 1916. (Mont. Exp. Station)

Type and allotype in United States National Museum.

The male of this species closely resembles that of *baltica*, differing essentially in that the abdomen is more densely cinerous gray pollinose, and the hind femur has no series of bristles on proximal half of anteroventral and posteroventral surfaces.

***Limnophora (Spilogona) parvimaculata* Stein**

Limnophora parvimaculata Stein, Arch. f. Naturgesch., 1920 (1918) May Abt. A Heft 9 pp. 47. 50.

Limnophora clivicola Malloch, Trans. Amer. Ent. Soc., 1920 June XLVI No. 802 p. 155.

Melanochelia clivicola Malloch, Canad. Ent., 1921 LIII p. 64.

Spilogona clivicola Johnson, Occ. Pap. Boston Soc. Nat. Hist., No. VII, 1925 p. 229.

Spilogona parvimaculata Hockett, Mem. 101 N. Y. (Cornell) Agric. Exp. Station, 1928 (1926) p. 834.

RECORDS:—

Ontario, 1 ♂, Ottawa, July 31, 1924; 1 ♀, Lyn, July 7, 1926. (C. H. Curran)

New York, 1 ♂, Buttermilk, Ithaca, July 14, 1920; 3 ♀, Sept. 25, 1920; 6 ♀, July 18, 1920; 2 ♀, Ithaca, June 30, 1913.

Illinois, 1 ♂, Alto Pass, June 5-6, 1919.

I feel confident that *clivicola* Malloch and *parvimaculata* Stein are the same species, having seen topotypical specimens of this striking species from Illinois and New York. The type and allotype of *clivicola* are in the collection of the Illinois Natural

History Survey at Urbana. The male type has the hind tibiæ slightly brownish.

Typically the eyes in the male are very large, restricting the frons to lineal dimensions. In addition the parafrontals, parafacials, and cheeks are very narrow when viewed in profile. The parafrontal bristles are strong and erect, continuing in series caudad to a level with frontal triangle. The abdomen is densely yellowish gray pollinose with the marks more or less perceptible beneath the pruinosity as dark reflections. In rubbed specimens the marks become more distinct. In the male specimen from Ottawa the characteristic appearance of the head is not so marked, the eyes being smaller with the result that the frons, parafacials, and cheeks are relatively broad, and in addition the abdominal marks are more apparent.

In the female the thorax and abdomen are grayish in color, the former with three brownish vittæ, and the latter with restricted brownish marks. Also the scutellum is entirely grayish, the mid femur has at most only one or two short bristles at base of posteroventral surface, and the wings are clear, hyaline.

***Limnophora (Spilogona) nitidifrons* Stein**

Limnophora nitidifrons Stein, Arch. f. Naturgesch., 1920 (1918) Abt. A Heft 9 p. 50.

This species was described by Stein from three females collected by Dr. Aldrich on Mount Rainier, Washington, August 7, 1905.

I am reluctant to believe that the species is valid owing to the fact that there are at least two females of other species recorded from this region that fit the description, namely, *Sphenomyia biquadrata* (Walker), and *Spilogona aerea* (Zetterstedt), and possibly *Spilogona concolor* (Stein) and *S. leucogaster* (Zetterstedt).

It is significant that Stein (60) on page fifty-six in the same article listed males of *leucogaster* as collected by Dr. Aldrich on Mount Rainier, Washington, on August 2, 1905. The males of *Sphenomyia biquadrata* are very similar to those of *leucogaster* except that in the former species vein *R.* 4+5 has a few setulæ toward base, and the halteres are more yellowish. The descrip-

tion of *nitidifrons* fits the females of *biquadrata* exactly, but as Stein makes no mention of vein *R*. 4 + 5 one is led to infer that it possessed no characters of specific importance. Only an examination of the type will make possible the identity of the species.

ADDITIONAL RECORDS

Since this paper has been prepared for publication Mr. Collin (6a) has recorded in his study of the Greenland species of *Limnophora* a number of additional forms. Some of these have been included in the present study of North American species, the remainder I have listed below.

Pseudolimnophora rotundata Collin

Limnophora sinuata Collin

Spilogona alpica Zetterstedt (= *latifrons* Stein)

Spilogona arctica Zetterstedt (= *fumipennis* Zetterstedt)

Spilogona deflorata Holmgren

Spilogona macropyga Frey

Spilogona latilamina Collin

Spilogona micans Ringdahl

Spilogona malaisei Ringdahl

Spilogona opaca Schnabl (= *freyi* Ringdahl)

Spilogona tornensis Ringdahl (= *seticosta* Ringdahl not Schnabl)

Spilogona trigonifera Zetterstedt

Spilogona freyi Ringdahl (Collin, 6b)

The following species are recorded as occurring in North America, but since I have not been able to recognize any of them I am unable to do more than list their names and records.

Aricia contractifrons Zetterstedt, Osten Sacken, Misc. Coll. Smithsn. Inst., 1878 III p. 166. North America

Limnophora litorea (Fallen), Slosson, Ent. News, 1895 VI p. 320. (determined by Coquillett) New Hampshire: Stein, Arch. f. Naturgesch., 1920 (1918) Abt. A Heft 9 pp. 47. 56. British Columbia

Limnophora nupta (Zetterstedt), Stein, Arch. f. Naturgesch., 1920 (1918) Abt. A Heft 9 pp. 48. 58. Idaho, Washington

Melanocheilia spinicosta Malloch, Proc. Cal. Acad. Sci., 1921 ser. 4 p. 181. Alaska

Melanocheila immaculiventris Malloch, Proc. Cal. Acad. Sci., 1923 ser. 4 XII No. 21 p. 425. Gulf of California.

The following species, in my opinion, belong to other genera.

Limnophora refusa (Giglio-Tos) Slosson, Ent. News, 1896 VII p. 263, (determined by Coquillett). New Hampshire.

Limnophora stygia (Meigen) Aldrich, Misc. Coll. Smithsn. Inst., 1905 XLVI No. 1444 p. 548. North America

REFERENCES

1. ALDRICH, J. M. A catalogue of North American diptera (or two-winged flies). Smithsonian Miscellaneous Collections, 1905 XLVI No. 1444 p. 546-548, 562.
2. ————. Two new genera of Anthomyidæ (Dipt.). Proceedings of the Entomological Society of Washington, 1919 XXI No. 5 p. 108.
3. BIGOT, J. M. F. Diptères nouveaux ou peu connus. 25th partie (1). XXXIII Anthomyzides nouvelles. Annales de la Société entomologique de France, 1885 (1884) ser. 6 IV p. 263-304.
4. BOHEMAN, C. H. Spetsbergens Insekt-Fauna. Öfversigt af Kongl. Vetenskaps-Akademiens Förhandlingar, 1865 XXII p. 563-577.
5. COLLIN, J. E. The British species of the anthomyid genus *Limnophora* Desv. (Diptera). Entomologist's Monthly Magazine, 1921 3rd ser. VII p. 94-100, 162-175, 238-248, 265-268.
6. ————. Diptera (Orthorrhapha Brachycera and Cyclorrhapha) from Spitsbergen and Bear Island. Results of the Oxford University Expedition to Spitsbergen, 1921. No. 22. Annals and Magazine of Natural History, 1923 ser. 9 XI p. 117-120.
- 6a. ————. A revision of the Greenland species of the anthomyid genus *Limnophora sens.-lat.* (Diptera), with figures of the male genitalia of these and many other palæarctic species. Transactions of the Entomological Society of London, 1930 LXXVIII Part 2 p. 255-281, pls. XV-XXVII.
- 6b. ————. The Oxford University Expedition to Greenland, 1928. —Diptera (Orthorrhapha Brachycera and Cyclorrhapha) from Greenland. Annals and Magazine of Natural History, 1931 ser. 10 VII p. 67-91.
7. COMSTOCK, J. H. The wings of insects. 1918 p. 1-430. 427 figs. 10 pls. (Comstock Publishing Company, Ithaca).
8. COQUILLET, D. W. Report on diptera of the Commander Islands. In The fur seals and fur seal islands of the North Pacific Ocean, 1899 IV p. 341-346.
9. ————. Papers from the Harriman Alaska expedition. IX. Entomological results (3): Diptera. Proceedings of the Washington Academy of Sciences, 1900 II p. 389-464.

10. ————. Report on a collection of dipterous insects from Puerto Rico. *Proceedings of the United States National Museum*, 1900 XXII No. 1198 p. 256-257.
11. ————. Types of Anthomyid genera. *Journal of the New York Entomological Society*, 1901 IX p. 139-140.
12. ————. The type-species of the North American genera of diptera. *Proceedings of the United States National Museum*, 1910 XXXVII No. 1719 p. 561, 566.
13. GIGLIO-TOS, E. Diagnosi di nuovi generi e di nuove specie di Ditteri, VIII. *Bollettino dei Musei di Zoologica ed Anatomia comparata della Reale Università di Torino*, 1893 VIII No. 147 p. 5-9.
14. ————. Ditteri del Messico, Parte IV Muscidae calypteratae, Muscinae, Anthomyinae; Muscidae acalypteratae, Scatophaginae, Helomyzinae, etc. 1895 p. 6-33.
15. HOLMGREN, A. E. Insekter fran Nordgrönland, samlade af Prof. A. E. Nordenskiöld år 1870. Öfversigt af Kongl. Vetenskaps-Akademiens Förhandlingar, 1873 (1872) No. 6 p. 101-103.
16. HOWARD, L. O. A contribution to the study of the insect fauna of human excrement (with special reference to the spread of typhoid fever by flies). *Proceedings of the Washington Academy of Sciences*, 1900 II p. 582.
17. JOHNSON, C. W. Article III.—Insects of Florida. I. Diptera. *Bulletin of the American Museum of Natural History*, 1913 XXXII Art. 3 p. 76.
18. ————. Fauna of New England. XV. List of the diptera or two-winged flies. *Occasional Papers of the Boston Society of Natural History*, Part VII, 1925 p. 228-230.
19. KARL, O. Die Tierwelt Deutschlands und der angrenzenden Meersteile. Teil XIII. Zweiflügler oder Diptera. III. Muscidae, 1928 p. 91-106. (publ. Gustav Fischer, Jena).
20. KOWARZ, F. Beitrag zur Dipteren-Fauna Ungarns. *Verhandlungen der Kaiserlich-Königlichen zoologisch-botanischen Gesellschaft in Wien*, 1873 XXIII p. 461.
21. LEONARD, M. D. A list of the insects of New York, with a list of the spiders and certain other allied groups. *Memoir 101 New York (Cornell) Agricultural Experiment Station*, 1928 (1926) p. 834.
22. LUNDBECK, W. Diptera Grönländica. *Videnskabelige Meddelelser fra den naturhistoriske Forening i Kjöbenhavn*, 1898 I p. 311, 312: 1901 (1900) II p. 289.
23. MACQUART, J. Anthomyzides. *In Histoire naturelle des insectes, Diptères*, 1835 II p. 293-297, 309-313.
24. ————. Anthomyzides. *In Diptères exotiques nouveaux ou peu connus. Supplément IV 1850 (1849) p. 234-235.*

25. MALLOCH, J. R. Three new species of Anthomyiidae (Diptera) in the United States National Museum Collection. Proceedings of the United States National Museum, 1913 XLV No. 2004 p. 603.
26. ———. Diptera from the southwestern United States. Paper IV. Anthomyiidae. Transactions of the American Entomological Society, 1918 XLIV No. 782 p. 273, 274.
27. ———. Descriptions of new North American Anthomyiidae (Diptera). Transactions of the American Entomological Society, 1920 XLVI No. 802 p. 145, 146.
28. ———. A synopsis of the North American species of the genera *Melanocheilia* Rondani and *Limnophora* R.-D., (Diptera, Anthomyiidae). Canadian Entomologist, 1921 LIII p. 61-64.
29. ———. Notes on some of Van der Wulp's species of North American Anthomyiidae (Diptera). Entomological News, 1921 XXXII p. 40-45.
30. ———. Exotic Muscaridae (Diptera).—I. Annals and Magazine of Natural History, 1921 ser. 9 VII p. 165.
31. ———. New and little-known calyptrate Diptera from New England. Psyche, 1924 XXXI No. 5 p. 200-202.
32. ———. Fauna Sumatrensis, (Beitrag No. 56). Family Muscidae (Dipt.). Mitteilungen Entomologische, 1928 Bd. XVII Nr. 4 p. 290, 296.
33. MEADE, R. H. Notes on the Anthomyiidae of North America. The Entomologist's Monthly Magazine, 1878 XIV p. 250-252.
34. ———. Annotated list of British Anthomyiidae. The Entomologist's Monthly Magazine, 1881 XVIII p. 101, 102.
35. ———. Descriptive list of British Anthomyiidae (in two parts), 1897 p. 1-79.
36. OSTEN SACKEN, C. R. Catalogue of the described Diptera of North America. Smithsonian Miscellaneous Collections, 1878 III No. 270 p. 166, 167.
37. PANDELLÉ, L. Études sur les muscides de France. Revue d'Entomologie, publiée par la Société Française d'Entomologie, 1898 XVII p. 22, 45, 50-80: 1899 XVIII p. 81-132.
38. POKORNY, E. Bemerkungen und Zusätze zu Prof. G. Strobl's "Die Anthomyinen Steiermarks." Verhandlungen der Kaiserlich-Königlichen zoologisch-botanischen Gesellschaft in Wien, 1894 (1893) XLIII p. 541.
39. RINGDAHL, O. Neue nordische Anthomyiden. Entomologisk Tidskrift, 1918 XXXIX Haft 2 p. 158-183.
40. ROBINEAU-DESVOIDY, J. B. Essai sur les Myodaires. Mémoires des savants étrangers de l'Académie Royale des Sciences de l'Institut de France, 1830 II p. 517-523.
41. ———. Histoire Naturelle des Diptères des Environs de Paris, 1863 II p. 635.

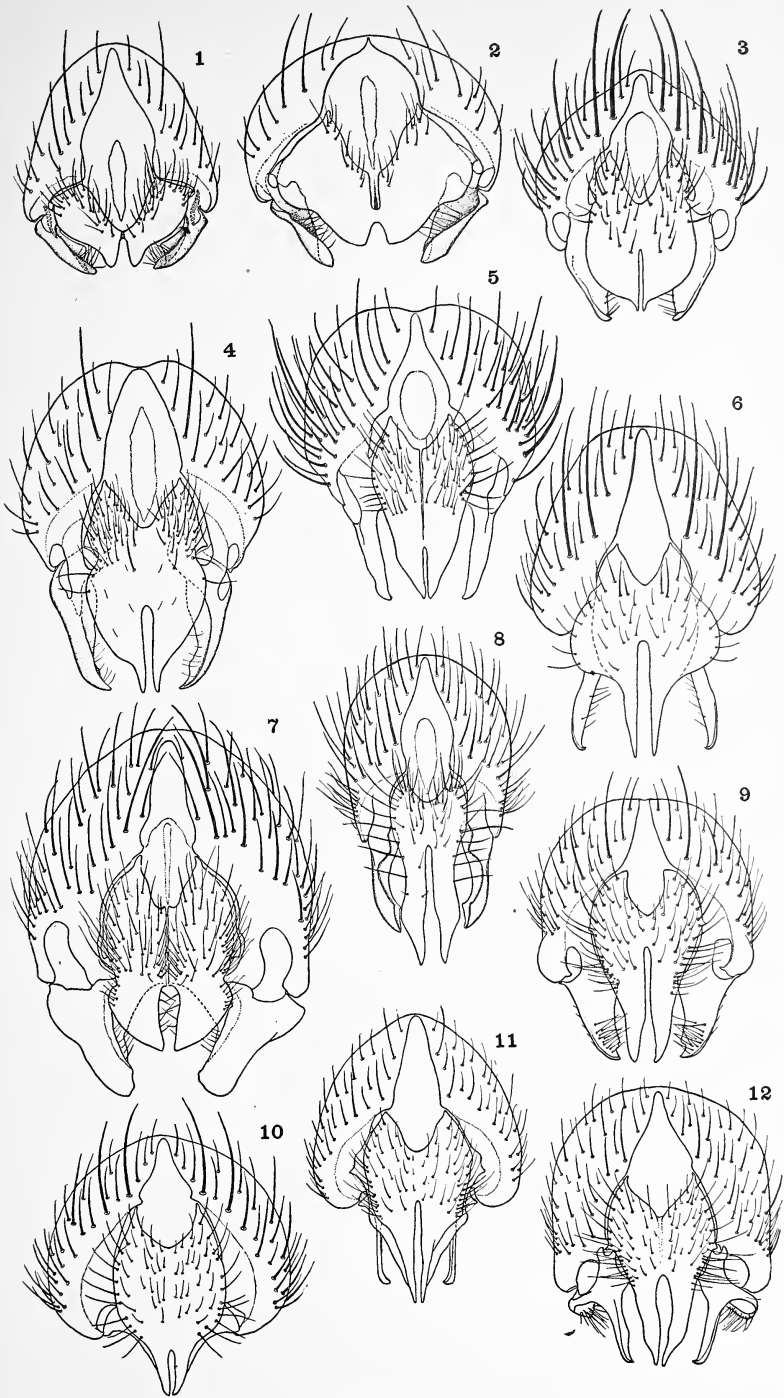
42. RONDANI, C. Anthomyinæ Italicæ collectæ distinctæ et in ordinem dispositæ. Della Società Italiana di Scienze Naturali, 1866 IX p. 72, 137, 193, 197.
43. ———. Diptera Italica non vel minus cognita descripta aut annotata. Fasc. IV. Addenda Anthomyinis. Prodrum Vol. VI. Bolletino del Società Entomologia d'Italia, 1870 II p. 11, 65–102, 103–107, 257.
44. SCHINER, I. R. Anthomyinæ. In Fauna austriaca, 1862 I p. 606, 664.
45. SCHNABL, J. Contributions à la faune diptérologique. Horæ Societatis Entomologicae Rossicae, 1889 XXIII p. 334–343.
46. ———. Characteres Essentiales nonnullorum generum subgenorumque Anthomyidarum. Horæ Societatis Entomologicae Rossicae, 1890 (1889–1890) XXIV p. 493–501.
47. ———. Dipterologische Bemerkungen II. Wein Entomologische Zeitung, 1902 XXI Heft 6 p. 127–135.
48. ———. Limnospila nov. gen. Anthomyidarum. Wein Entomologische Zeitung, 1902 XXI p. 111.
49. SCHNABL, J. AND DZIEDZICKI, H. Die Anthomyiden. Abhandlungen der Kaiserl. Leop.-Carol. Deutschen Akademie der Naturforscher, Nova Acta, 1911 Bd. XCV Nr. 2 p. 141–154.
50. SEAMANS, H. L. A new species of muscid from Alberta (Diptera) Canadian Entomologist, 1926 LVIII p. 175.
51. SÉGUY, E. Diptères Anthomyides. In Faune de France, Part VI, 1923 p. 195–196.
52. SLOSSON, A. T. List of diptera from the White Mountains, New Hampshire. Entomological News, 1894 V p. 6: 1895 VI p. 6, 7, 319, 320: 1896 VII p. 263, 264: 1897 VIII p. 239, 240: 1898 IX p. 252: 1900 XI p. 320, 321: 1902 XIII p. 7, 8, 319, 320.
53. STAEGER, C. Grönland's Anliater. In Kröjer's Naturhistoriske Tidsskrift, new series, 1845 I p. 364.
54. STEIN, P. Nordamerikanische Anthomyiden. Beitrag zur Dipterenfauna der Vereinigten Staaten. Berliner Entomologische Zeitschrift, 1898 (1897) Bd. XLII Heft 3 and 4 p. 161–288.
55. ———. Die Amerikanischen Anthomyiden des Königlichen Museums für Naturkunde zu Berlin und des Ungarischen National-Museums zu Budapest. Annales Musei Nationalis Hungarici, 1904 II p. 459.
56. ———. Anthomyidæ. In Katalog der Paläarktischen Dipteren, 1907 III p. 669–676, 747.
57. ———. Die von Schnuse in Südamerika gefangenen Anthomyiden. Archiv für Naturgeschichte, 1911 Abt. A Heft I p. 111–137.
58. ———. Die Anthomyiden Europas. Archiv für Naturgeschichte, 1916 (1915) Abt. A Heft 10 p. 83–112.

59. Die Anthomidengattungen der Welt, analytisch bearbeitet, nebst einem kritisch-systematischen Verzeichnis aller aussereuropäischen Arten. Archiv für Naturgeschichte, 1919 (1917) Abt. A Heft 1 p. 133-137.
60. ———. Nordamerikanische Anthomyiden. 2 Beitrag. Archiv für Naturgeschichte, 1920 (1918) Abt. A Heft 9 p. 1-106.
61. STROBL, G. Die Anthomyinen Steiremarks. (mit Berücksichtigung der Nachbarländer). Verhandlungen der Kaiserlich-Königlichen zoologisch-botanischen Gesellschaft in Wien, 1894 (1893) XLIII p. 220, 272, 273.
62. VAN DER WULP, F. M. Group Anthomyinæ, Diptera. Biologia Centrali-Americana, 1896 II p. 312-347.
63. WESTWOOD, J. O. Synopsis of the genera of British flies. In An introduction to the modern classification of insects, 1840 II p. 143.
64. WILLISTON, S. W. XI. On the diptera of St. Vincent, (West Indies). (Dolichopodidæ and Phoridæ, by Professor J. M. Aldrich). Transactions of the Entomological Society of London, 1896 Part III p. 253-446.

PLATE VII

Dorsal or caudal aspect of male copulatory appendages

- Figure 1. (*Limnophora*) *narona* (Walker)
- Figure 2. (*Limnophora*) *discreta* Stein
- Figure 3. (*Spilogona*) *narina* (Walker)
- Figure 4. (*Spilogona*) *subrostrata* Stein
- Figure 5. (*Spilogona*) *novæ-angliæ* Malloch
- Figure 6. (*Spilogona*) *sospita* new species
- Figure 7. (*Spilogona*) *fatima* new species
- Figure 8. (*Spilogona*) *tetrachæta* Malloch
- Figure 9. (*Spilogona*) *concolor* Stein
- Figure 10. (*Spilogona*) *obscuripennis* Stein
- Figure 11. (*Spilogona*) *addicta* new species
- Figure 12. (*Spilogona*) *area* (Zetterstedt)

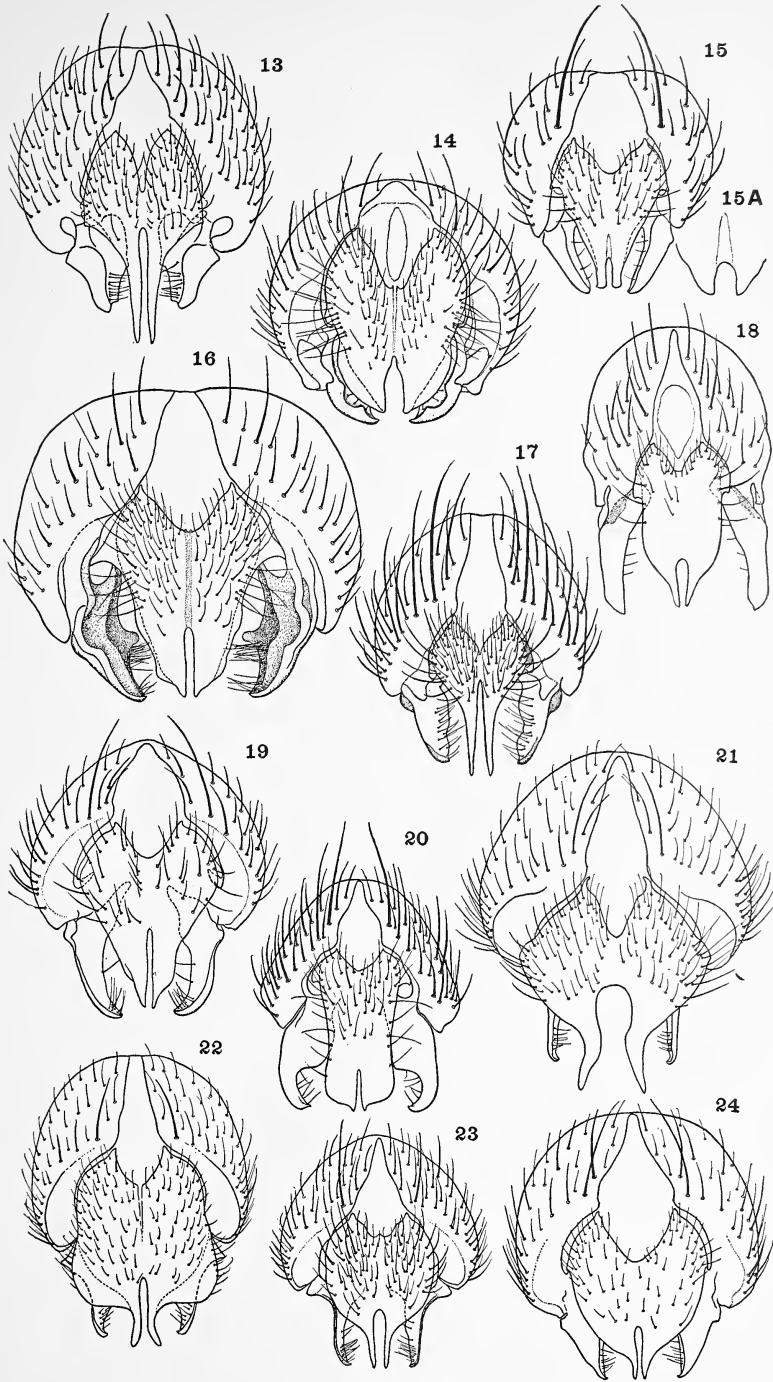


LIMNOPHORA

PLATE VIII

Dorsal or caudal aspect of male copulatory appendages

- Figure 13. (*Spilogona*) *pulvicrura* new species
Figure 14. (*Spilogona*) *nobilis* Stein
Figure 15. (*Spilogona*) *argentiventris* Malloch
Figure 15a. (*Spilogona*) *argentiventris occidentalis* new variety
Figure 16. (*Spilogona*) *rufitarsis* Stein
Figure 17. (*Spilogona*) *alliterata* new species
Figure 18. (*Spilogona*) *fuscomarginata* new species
Figure 19. (*Spilogona*) *torreyæ* Johannsen
Figure 20. (*Spilogona*) *crassiventris* new species
Figure 21. (*Spilogona*) *acuticornis* Malloch
Figure 22. (*Spilogona*) *surda* (Zetterstedt)
Figure 23. (*Spilogona*) *bisetosa* new species
Figure 24. (*Spilogona*) *rufitibia* Stein



LIMNOPHORA

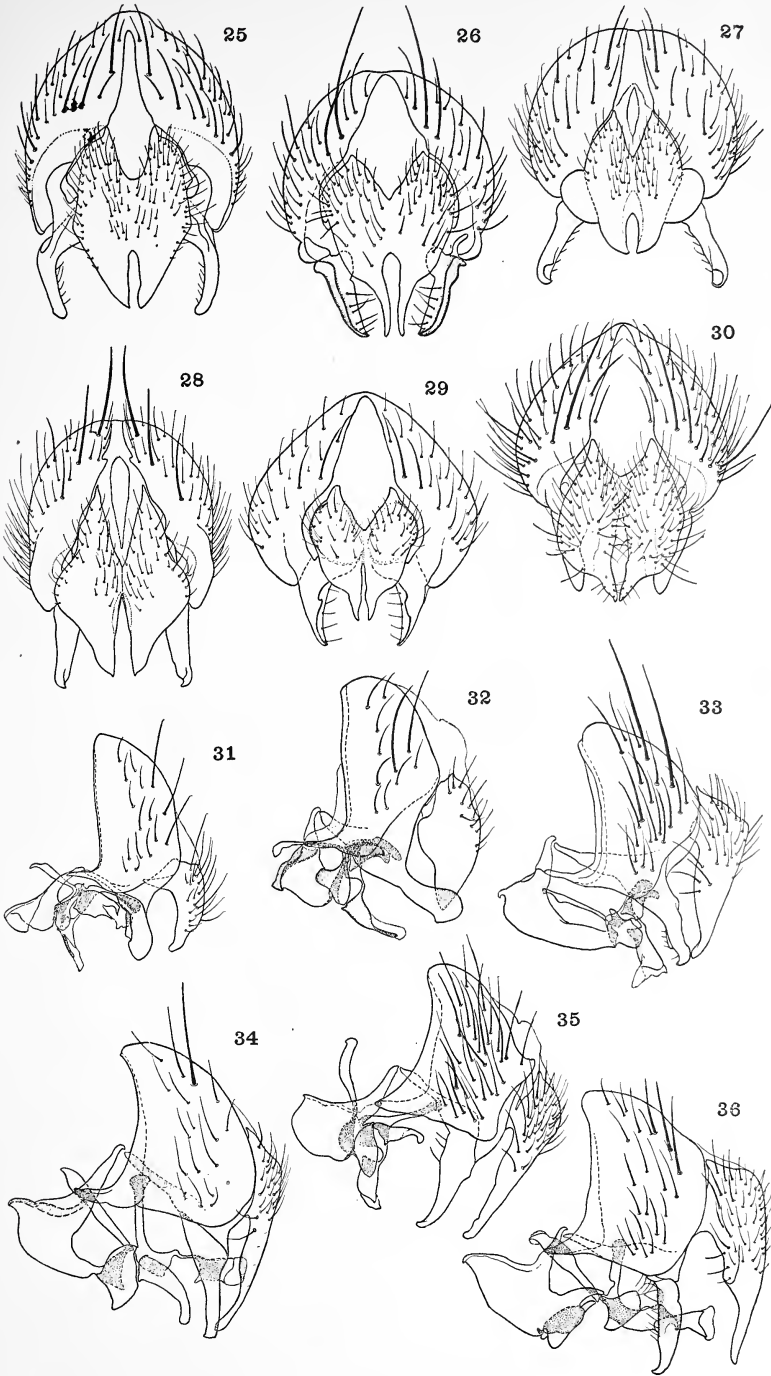
PLATE IX

Dorsal or caudal aspect of male copulatory appendages

- Figure 25. (*Spilogona*) *suspecta* Malloch
Figure 26. (*Spilogona*) *pluvialis* new species
Figure 27. (*Spilogona*) *contractifrons fumipennis* (Zetterstedt)
Figure 28. (*Spilogona*) *alticola* Malloch
Figure 29. (*Spilogona*) *anthrax* Bigot
Figure 30. (*Spilogona*) *magnipunctata* Malloch

Lateral aspect of male copulatory appendages

- Figure 31. (*Limnophora*) *narona* (Walker)
Figure 32. (*Limnophora*) *discreta* Stein
Figure 33. (*Spilogona*) *narina* (Walker)
Figure 34. (*Spilogona*) *subrostrata* Stein
Figure 35. (*Spilogona*) *novæ-angliæ* Malloch
Figure 36. (*Spilogona*) *sospita* new species

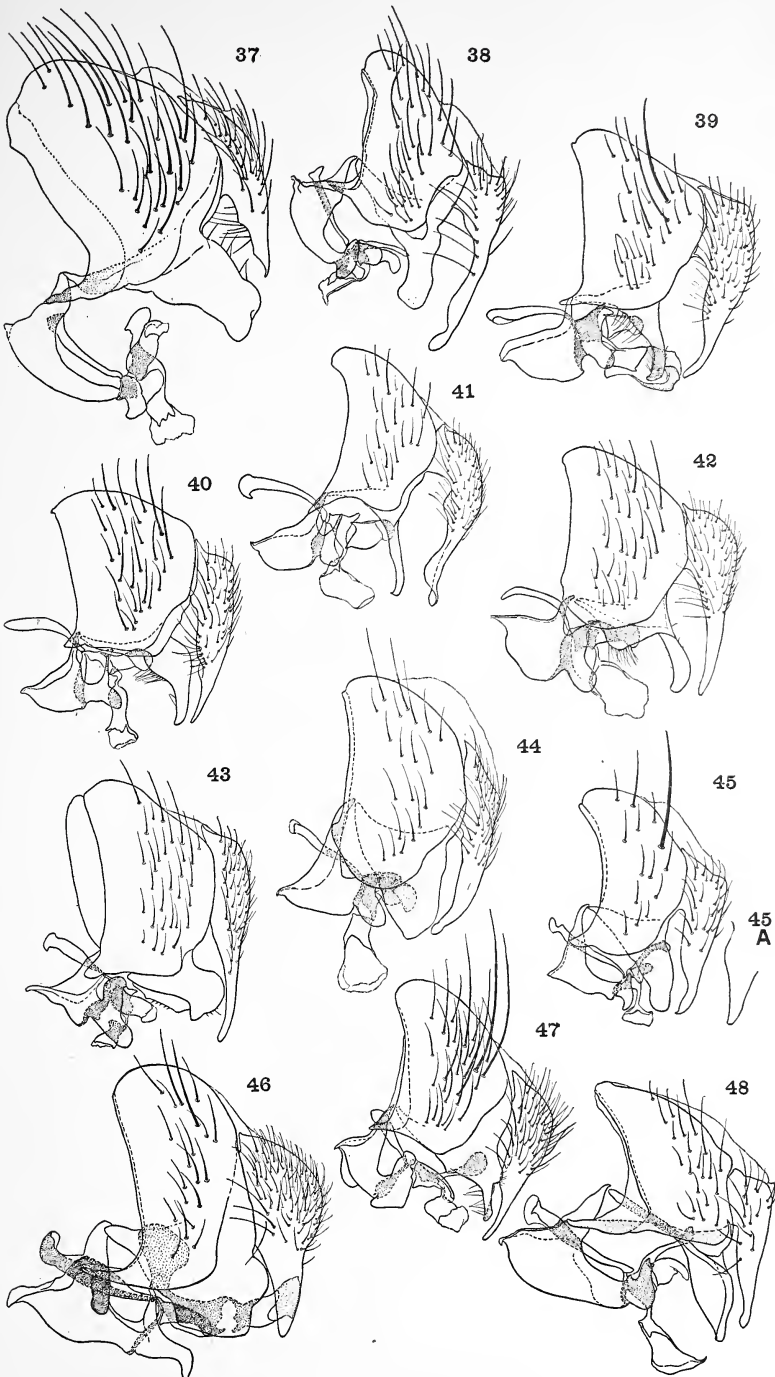


LIMNOPHORA

PLATE X

Lateral aspect of male copulatory appendages

- Figure 37. (*Spilogona*) *fatima* new species
Figure 38. (*Spilogona*) *tetracheta* Malloch
Figure 39. (*Spilogona*) *concolor* Stein
Figure 40. (*Spilogona*) *obscuripennis* Stein
Figure 41. (*Spilogona*) *addicta* new species
Figure 42. (*Spilogona*) *ærea* (Zetterstedt)
Figure 43. (*Spilogona*) *pulvicura* new species
Figure 44. (*Spilogona*) *nobilis* Stein
Figure 45. (*Spilogona*) *argentiventris* Malloch
Figure 45a. (*Spilogona*) *argentiventris occidentalis* new variety
Figure 46. (*Spilogona*) *rufitarsis* Stein
Figure 47. (*Spilogona*) *alliterata* new species
Figure 48. (*Spilogona*) *fuscomarginata* new species

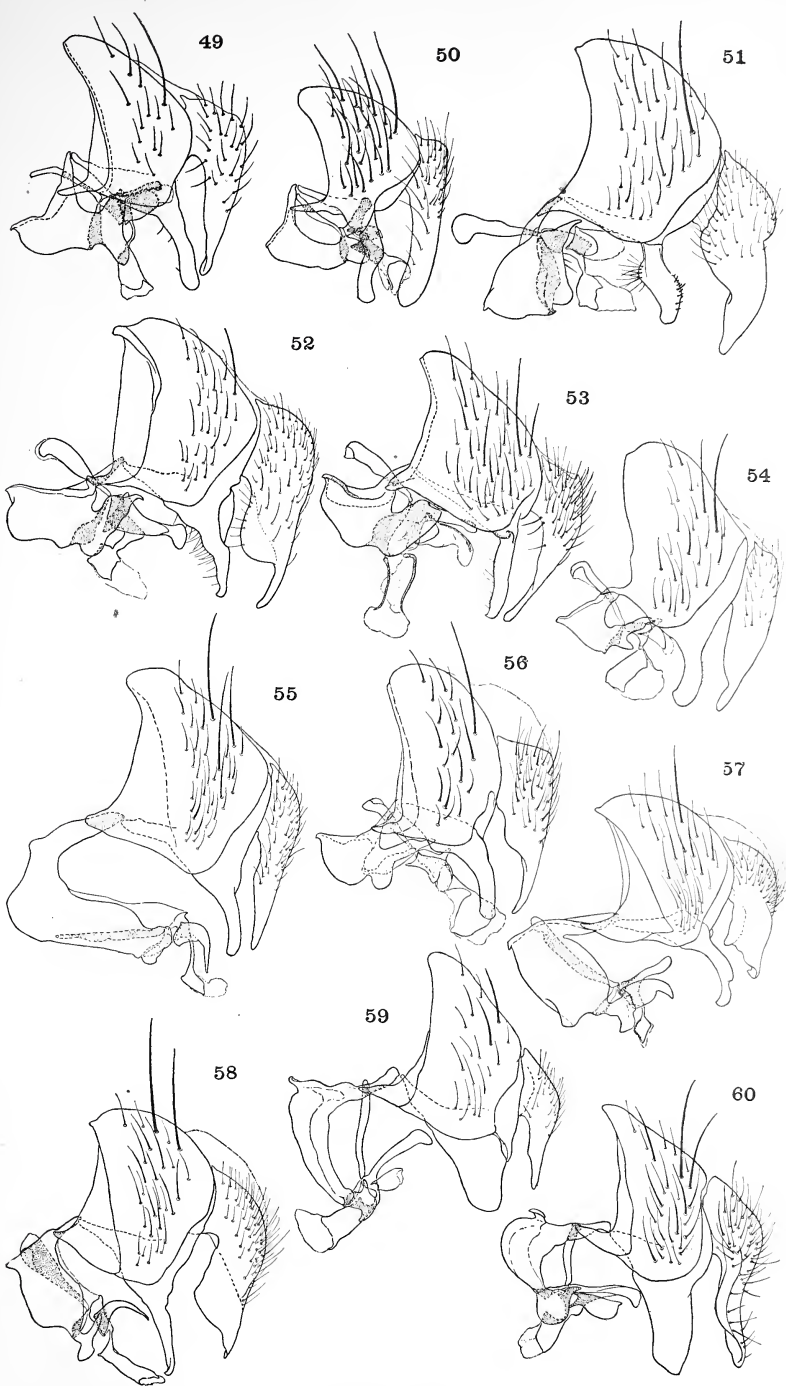


LIMNOPHORA

PLATE XI

Lateral aspect of male copulatory appendages

- Figure 49. (*Spilogona*) *torreyæ* Johannsen
Figure 50. (*Spilogona*) *crassiventris* new species
Figure 51. (*Spilogona*) *acuticornis* Malloch
Figure 52. (*Spilogona*) *surda* (Zetterstedt)
Figure 53. (*Spilogona*) *bisetosa* new species
Figure 54. (*Spilogona*) *rufitibia* Stein
Figure 55. (*Spilogona*) *suspecta* Malloch
Figure 56. (*Spilogona*) *pluvialis* new species
Figure 57. (*Spilogona*) *contractifrons fumipennis* (Zetterstedt)
Figure 58. (*Spilogona*) *alticola* Malloch
Figure 59. (*Spilogona*) *anthrax* Bigot
Figure 60. (*Spilogona*) *magnipunctata* Malloch

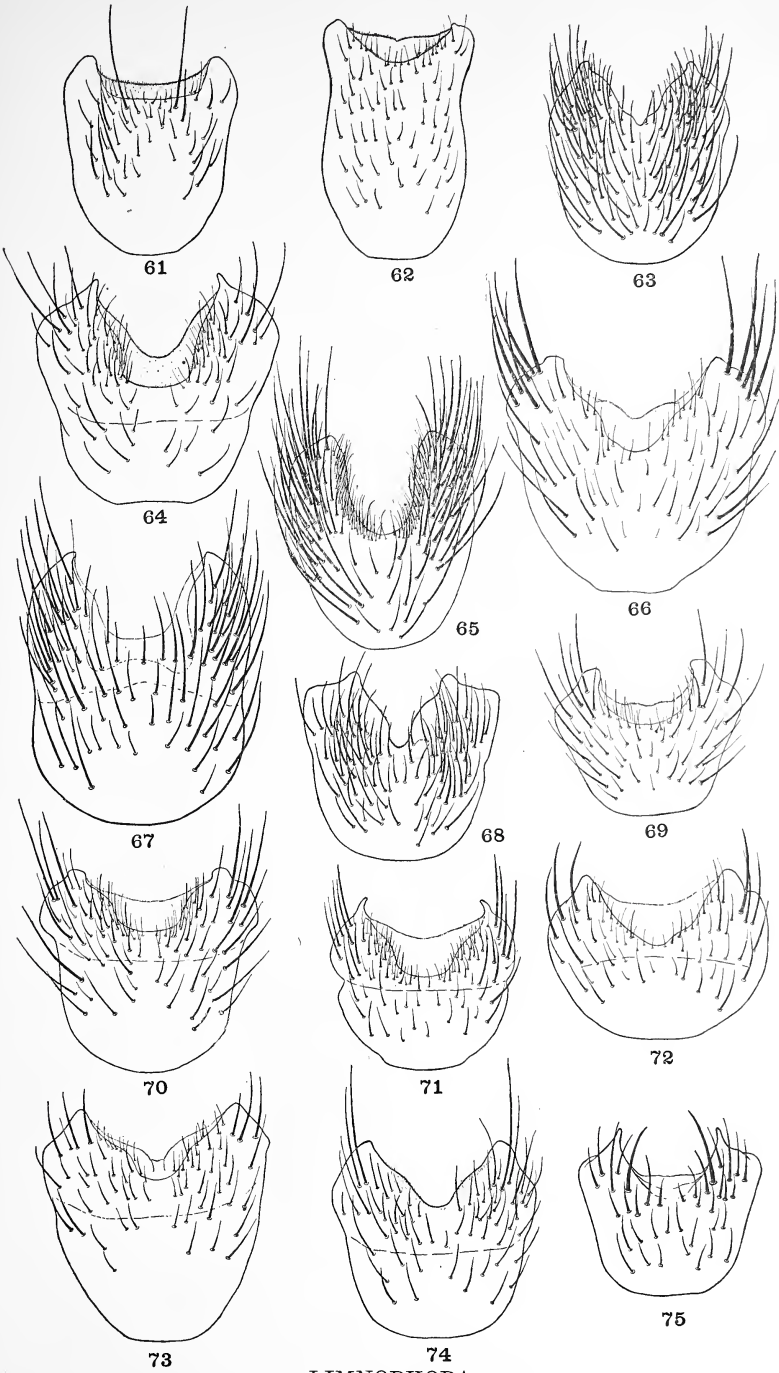


LIMNOPHORA

PLATE XII

Ventral aspect of sternum five in male

- Figure 61. (*Limnophora*) *narona* (Walker)
- Figure 62. (*Limnophora*) *discreta* Stein
- Figure 63. (*Spilogona*) *narina* (Walker)
- Figure 64. (*Spilogona*) *subrostrata* Stein
- Figure 65. (*Spilogona*) *novæ-angliæ* Malloch
- Figure 66. (*Spilogona*) *sospita* new species
- Figure 67. (*Spilogona*) *fatima* new species
- Figure 68. (*Spilogona*) *tetrachacta* Malloch
- Figure 69. (*Spilogona*) *concolor* Stein
- Figure 70. (*Spilogona*) *obscuripennis* Stein
- Figure 71. (*Spilogona*) *addicta* new species
- Figure 72. (*Spilogona*) *ærea* (Zetterstedt)
- Figure 73. (*Spilogona*) *pulvicrura* new species
- Figure 74. (*Spilogona*) *nobilis* Stein
- Figure 75. (*Spilogona*) *argentiventris* Malloch

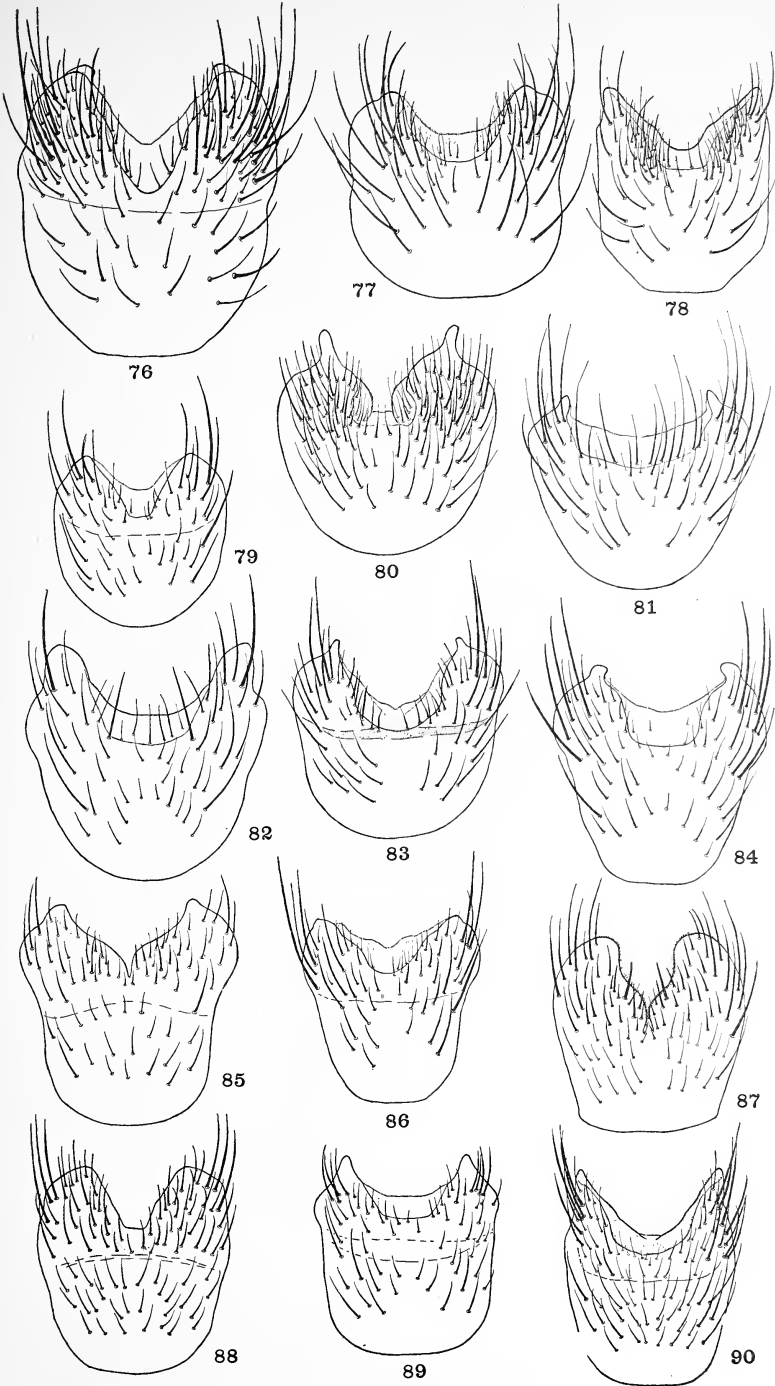


74
LIMNOPHORA

PLATE XIII

Ventral aspect of sternum five in male

- Figure 76. (*Spilogona*) *rufitarsis* Stein
Figure 77. (*Spilogona*) *alliterata* new species *
Figure 78. (*Spilogona*) *fuscomarginata* new species
Figure 79. (*Spilogona*) *torreyæ* Johannsen
Figure 80. (*Spilogona*) *crassiventris* new species
Figure 81. (*Spilogona*) *acuticornis* Malloch
Figure 82. (*Spilogona*) *surda* (Zetterstedt)
Figure 83. (*Spilogona*) *bisetosa* new species
Figure 84. (*Spilogona*) *rufitibia* Stein
Figure 85. (*Spilogona*) *suspecta* Malloch
Figure 86. (*Spilogona*) *pluvialis* new species
Figure 87. (*Spilogona*) *contractifrons fumipennis* (Zetterstedt)
Figure 88. (*Spilogona*) *alticola* Malloch
Figure 89. (*Spilogona*) *anthrax* Bigot
Figure 90. (*Spilogona*) *magnipunctata* Malloch



LIMNOPHORA

SYNOPSIS OF THE CICINDELIDÆ

I. General Introduction, Bibliography and Purpurea Group

BY ALAN S. NICOLAY AND HARRY B. WEISS

This is the first of a series of papers which, we hope, will eventually include all the species (and varieties) of tiger beetles known to occur in boreal America north of Mexico and exclusive of the West Indies, in other words the same field covered by Mr. Leng in his monumental work, "Catalogue of the Coleoptera of America 1920."

It would, undoubtedly, be preferable to publish one large paper on the entire family. However, the spare time of both authors is very limited, and we deemed it more desirable to publish our findings in the various groups in serial form rather than postpone the entire paper to a far distant date. Many new species, varieties and, unfortunately synonyms have been described since Mr. Leng's Revision* and also two complete lists, that of Mr. E. D. Harris in 1911 and Dr. Walther Horn in 1930, but at present there is no up-to-date paper enabling the student to properly identify his "tigers" and giving at the same time the rather involved synonymy of this attractive and popular family. Thus the two main objectives of this paper are not only to fill the above need, but also to furnish a prelude for a complete monographic work on the Cicindelidæ of North America. In addition to the synoptic keys and synonymy, we include the briefest of individual descriptions, giving a few salient characters and also general remarks and approximate distribution of each species and variety.

We feel that the best results are obtainable by recognizing only species and varieties as is done in our check lists and most papers on North American insects. While it is true that certain species are more entitled to specific rank than others and some

* Revision of the Cicindelidæ of Boreal America. Trans. Am. Ent. Soc. XXVIII, March, 1902.

varieties are more pronounced than others, nevertheless the attempt to "grade" these units into subspecies, phases, etc., generally leads to considerable confusion and only increases the present chaotic condition of most families of the Coleoptera to-day. It is difficult enough to get students to agree on what constitutes a species and what constitutes a variety without complicating the subject with further minor classifications and "split-ups." The object of this paper is to simplify matters and not to blunder around in long discussions and arguments most of which lead nowhere.

Dr. Walther Horn has listed our species in a most admirable and conservative paper, "Notes on the Races of *Omus californicus* and a List of the Cicindelidæ of America North of Mexico," Trans. Amer. Ent. Soc. LVI, pp. 73-86, 1930. His views are the antitheses of the late Colonel Casey and in our humble opinion much more preferable and accurate. By elevating his subspecies (listed with Roman numerals) to specific rank and considering his varieties (listed with letters) and phases (listed with symbols) as varieties, one has a complete check list of our forms. This applies especially to his excellent work on the genus *Omus* which otherwise would be in such a chaotic condition as to make it impossible for even a specialist to properly identify his material without weeks of study and examining the Casey types in Washington.

We have endeavored to be liberal in recognizing varieties. There are two distinct types of these varieties. One group is of those forms which, while occurring in the same localities as the stem species, nevertheless differ sufficiently either in color, markings, or more rarely size, as to warrant giving them varietal names. As an example the well-known green form so common to most of our eastern pine barrens *Cicindela scutellaris* var. *rugifrons* and the black form var. *modesta* occur together in most localities while in others only one is found. The other group consists of those forms which may differ greatly or very slightly, as the case may be, but are geographical races and never found with the stem species. We believe these varieties are much more important than the first group and represent future valid species although the present differences may be very slight.

Many examples of these are found in the *purpurea* group which is treated in this paper.

We do not condone recognizing the intermediates between species and varieties. In the North Eastern states, the maculated variety *rugifrons* is most often met with, while in Florida and the Southern States, the immaculate variety *unicolor* prevails. Occasionally specimens of each are met with in the territory of the others and as one would suspect the location between might have an almost even sprinkling of both forms. This is exactly the case in the Carolinas, and led Mr. Harris to describe variety *carolina*. We feel that this is wrong and unnecessary, and if the locality labels were removed it would be impossible to differentiate between lightly marked specimens taken in Massachusetts and Long Island, New York, and those from the South.

It is very undesirable to name sports, monstrosities and uniques in such a variable family as the Cicindelidæ.

In arranging the synonymy, we have left out all names of which no published description exists, that is names used in letters, written by individuals, which names have crept into our already overburdened synonymy.

We wish to thank for help either in putting museum material at our disposal or supplying valuable data Mr. Charles W. Leng, Mr. Andrew J. Mutchler, Mr. L. L. Buchanan, Mr. Herbert S. Barber, Mr. E. T. Cresson, Jr., Mr. C. A. Frost, Prof. H. C. Fall and Mr. Warren Knaus.

Cicindelidæ

Antennæ filiform, 11-jointed, inserted on the front above the base of the mandibles, which are long and sharply toothed: Clypeus produced laterally over the base of the antenna; hind coxæ mobile and simple; abdomen of female 6-articulate, of male usually 7-articulate.

The male genitalia used so much in recent years in the classifications of certain groups has not been greatly studied in the Cicindelidæ. Dr. Walther Horn, who has examined this member in the difficult *Omus* group, decided that it had only the same value as any other character and was equally subject to variation. We are entirely out of sympathy with those genitalia

enthusiasts who make or break a species on this character alone, entirely disregarding all other structures and differences.

Unquestionably the genitalia is helpful if taken along with or backed up by other differences and even geographical distribution, but the naming of species on this character alone is too preposterous in our minds to be taken seriously and we are forced to the conclusion that it has been seized upon as "a happy hunting ground" for splitters and confusionists.

In the final paper, (after we have published synoptic keys of all the species and varieties) we will publish a synoptic key of the tribes, genera and stem species only and also a list of all species, varieties and synonyms. Each paper will have a bibliography covering only those forms taken up in the particular article. The bibliography in this paper will also include the more important works on North American *Cicindelidæ*.

Genus *Cicindela* L. 58-407

The *Purpurea* Group

Humeral angles distinct; winged species; abdomen not red; thorax not margined; pubescence beneath erect; anterior tarsi male broadly dilated; labrum well developed; elytra granulate punctate; front hairy.

KEY TO PURPUREA GROUP

- Elytra with short oblique middle band (never with a marginal line) and usually an anteapical dot; thorax, head and elytra always the same or about the same color (1)
- Elytra with middle band transverse at base; maculation complete to entirely immaculate, except for apical dot; thorax and elytra sometimes different in color, rarely with a marginal line (2)
- (1) Reddish cupreous to bronzed **purpurea**
 Green often with slight cupreous reflections, especially pronounced on thorax var. *auduboni*
 Black var. *nigerrima*
- (2) Elytra without marginal line (3)
 Elytra with marginal line (12)
- (3) Elytra and thorax coppery reddish to a greenish sericeous shade (4)
 Thorax green to a French blue (6)
- (4) Middle band sinuate, with or without anteapical, humeral and post-humeral dots (5)
 Middle band short and transverse var. *transversa*

This common and widely distributed species is known to almost all beetle collectors and even general entomologists. *Purpurea* and its two varieties can be readily told from the other species by the very constant short oblique middle band. In very long intervals, an occasional specimen is taken lacking the middle band. We know of only one authentic record: namely, Mr. C. A.

Frost took a single example at Hopkinton, Massachusetts, April 13. This may be regarded as a sport, and as many typical specimens were found in the same locality, it carries no geographical significance. Specimens from New England and northern New York often show the tendency to verge on greenish, approaching the western variety *auduboni*.

Although common where found, and widely distributed, *purpurea* is moderately local. It occurs from Canada through Kentucky and Tennessee.

The range listed is from the Atlantic to the Pacific, but probably most or all of the west coast records refer to its varieties. Mr. Loding reports its absence in Alabama and it is not reported from South Carolina south or in the southwest or from California. In the vicinity of New York City it is found in the spring (April-May) and again in the autumn (end of August-September) disappearing pretty much during the summer months. Found commonly on old roads, especially in pine barrens of Long Island, New York, where some of the more brilliant phases are met with.

var. *auduboni* Lec. 45-207 (*graminea* Schp. 83-89; *lauta* Casey 97-296; *franciscana* Casey 13-23; *mirabilis* Casey 14-358)

This geographical variety can be told from *purpurea* only by its greenish color. The shade of green is quite often variable, depending somewhat upon the locality but varies usually very slightly in the same location. We cannot see any grounds for retaining *lauta*. When the senior author, who examined the type, asked Mr. Leng why this name was listed even as a variety he replied, "to be generous to Colonel Casey." As Mr. Leng pointed out in the JOURNAL OF THE NEW YORK ENTOMOLOGICAL SOCIETY, Vol. XXVI, p. 139, this name was first given by LeConte to this green western variety but later applied also for the black variety (*nigerrima*, Leng). Consequently while it is feasible to separate this slight color phase because it is sustained also by a restricted range, we do not feel that different shades of color or size of specimens should be construed as warranting names. Some of the specimens verge on the bluish or have margins of elytra bluish. This applies especially to specimens from Cali-

fornia. We should not be surprised to hear of *auduboni* turning up sometime locally in the north east as well as out west. One specimen from the Catskill Mts., New York, in the senior author's collection is entirely a dull green and nearer *auduboni* than the true *purpurea*, but until more such specimens turn up, we will leave it as *purpurea*, thereby not extending its range for the present. All of Casey's *auduboni* are *nigerrima*, Leng.

Ranges from Kansas and Utah to the Pacific Coast. Also listed as being taken in Illinois and Minnesota. Mr. F. S. Carr has sent us some examples caught in Medicine Hat, Alberta, April 14-21. Other specific records are Brookings, S. D.; Stockton, April 20, Utah; Oakley, September 24, Kansas; Rapelje, September 1, Montana. Also many records from California to British Columbia.

var. *nigerrima* Leng, 18-139 (*auduboni* || Lec. 57-37)

The black variety having approximately the same range as *auduboni* except that it is taken sporadically but very rarely in the East. Mr. C. A. Frost reports one from Nobscot (Framingham), September 4, Massachusetts. The senior author took one at Lakehurst, September 6, New Jersey, when in the company of his good friend and collecting companion Mr. Ernest Shoemaker. Some eight species and 130 specimens of tiger beetles were bagged on that occasion, and in the field the author thought he had a partially maculated form of the pine barren *Cicindela consentanea* which is remarkably constant. This isolated specimen coming from the pine barrens of southern New Jersey (not the northern part of the state) and from such a thoroughly collected locality as Lakehurst was a great surprise. Also from Brookings, South Dakota; Denver, Colorado; Wyoming; Chicago, April 19, Illinois; Oakley, September 24, Kansas; Beaver Dam, September 11, Wisconsin; Ragton, New Mexico; Medicine Hat, April and Sept. (Carr), Alberta; Jefferson County, June 20, Montana.

C. *limbalis*, Klug, 34-29 (*amæna* Lec. 48-177; *splendida* ≠ Lec. 57-36; *awemeana* Casey, 13-23; *eldorensis* Casey, 13-23; *militaris* Varas, 28-242)

Markings mostly complete but often with the humeral, post-humeral and anteapical dots partially or entirely lacking. Middle band and apical dot always present, the former rather long and sinuate but transverse at base. Color varies from a cupreous to a distinct reddish and often specimens are found around New York City of either an Indian red or Cologne earth shade (brownish hues). Examples from the middle west appear duller and paler than those taken in the Atlantic States. Varas saw fit to honor certain specimens from the Atlantic States which lacked some of the usual dots and as he put it "had a violet hue" with the name *militaris*, but Horn relegated it (and in our opinion correctly) to synonymy. *Eldorensis* Casey, is a synonym also of *limbalis* and not *transversa*. In the Casey collection his *limbalis* from Connecticut is the variety *spretæ*, while his true *limbalis* specimens were known to him as *amæna*.

This species is one of the most beautiful beetles found at least in the east. It is a strong flier and is met with around New York City locally along high and little-used roads, and the bare tops of the hills of the Hudson Valley and Greenwood Lake section of New Jersey during the spring (end of April-May) and again in the autumn (end of August-October 15). Also from Argentine, April-May, Kansas; Kansas City, March 24, Montgomery City, October 12, (Clark) Missouri; Iowa City, September 11, (Wickham), Iowa; Aweme, April 30 (Criddle), Manitoba; Edmonton, June 3 (Carr), Alberta; Cochrane, August 30 (Notman), Ontario; Malcolm, March 23, Nebraska; Nantucket, September 14, Massachusetts; Michigan; Ohio, Kentucky, etc. Apparently does not occur in the South Atlantic States or California.

var. *transversa* Leng, 02-131.

This variety is, to our minds, a very slight departure from the stem species *limbalis* but is worth retaining because it represents the intermediate or connecting link between this species and *splendida*. Its chief and only deciding character is the middle band being reduced to a short transverse line at the margin of the elytra. The various other dots are usually much less distinct than in *limbalis* and often all or most are entirely

absent. As might be imagined, intermediates are often encountered in Kansas (Argentine) which is apparently one of the rare localities where both *limbalis* and var. *transversa* and *splendida* and var. *cyanocephala* occur together. Certain specimens of *transversa* have the thorax with a brassy shine approaching the next species *splendida*. There is also a specimen in the collection of Mr. Ernest Shoemaker from the District of Columbia where *splendida* is found, but to our knowledge never *limbalis* (probably being just a little too far south).

Despite these geographical "alliances," we are of the opinion that Mr. Edward Harris was correct when he wrote his list of Cicindelidæ* in placing *transversa* as a variety of *limbalis* and it is not a variety of *splendida* as construed by Walther Horn and followed by Leng in his check list, although he originally described it as a variety of *purpurea*, also placing *limbalis* as a variety of that species and regarding *splendida* as a good species. This certainly appears to be more natural and correct. In New York and New Jersey (where *splendida* has not been found) in a series of forty or fifty specimens of *limbalis* generally one or two turn out to be *transversa*. Therefore, while it is found in company with *splendida* at the meeting point of this southern species and *limbalis*, *transversa* is found more often in company with the more northern *limbalis* where *splendida* is never taken. Lawrence, Argentine, March through May, Kansas; Eureka, April 30 (Smyth), Missouri; District of Columbia; Greenwood Lake, May 4, (Nicolay) New Jersey.

var. *spretta* Lec. 48-177.

It is advisable to retain this name to separate that form, occurring only in the northeast, which has the usual cupreous color more or less suffused with green. The markings appear remarkably constant and complete and the elytra are duller and less shining than the typical *limbalis*. Although it is not correct to apply this name to the dark forms of *limbalis* found around New York City, we would include the more brownish or alutaceous specimens found in company with the true *spretta* by Harris at Mount Desert, Maine, in August.

* Truan Press, Yonkers, N. Y., 1911.

Monmouth, June 24 (Frost), Maine; Westfield, May 19 (Notman), New York; Ravina, July 16, (Liljeblad), Illinois; Wisconsin.

var. *auguralis* Casey, 13-21 (*inducta* Casey, 13-22; *ardelio* Casey, 13-21)

A western variety which can be separated by characters given in the key. It is hard to understand why Casey described it as a variety of *purpurea* with the resulting incorrect synonymy in the Leng list of Coleoptera.

Described from, and so far known only from, Colorado and New Mexico. Walther Horn in his 1930 list of North American Cicindelidæ apparently included the dull form of *limbalis* from Kansas under this variety. Our minds are open on the ultimate correctness of this but until more material is collected, we prefer to leave Kansas specimens under the name *limbalis*.

C. splendida Hentz, 30-254 (*discus* Klug, 34-23)

This beautiful species and its varieties can be told from all others of the group by the green or bluish thorax. It is southern in its range and, undoubtedly, all records in the East north of the District of Columbia and vicinities (it may be found in Maryland when this state is more thoroughly collected) are erroneous. As an example of how easy it is to list incorrect localities, there is a specimen in the American Museum, New York, marked "Br. Col." undoubtedly referring to the "District of Columbia." Specimens from Kansas and Nebraska usually have a more brassy sheen than those from the South Atlantic States. The thorax is a uniform light green on the many specimens taken in Virginia by the senior author while those seen from Kansas and Nebraska range from a deep French blue to bluish green and rarely light green as in eastern specimens. We certainly hope that no future "splitter" decides to honor these colors with a name. They are interesting but of no decided geographical value. In looking over the Casey collection, we find that all his "*splendida*" with the exception of one or two doubtful examples are the variety *cyanocephala*.

Splendida is very faintly and finely marked as compared with *C. limbalis* and in this respect approaches of course *C. limbalis*

var. *transversa*. Usual markings consist of short transverse middle band apical dot and more rarely anteapical dot. One specimen from Mount Vernon, Virginia, taken by the senior author has the middle band narrow but decidedly sinuate and a posthumeral dot thus approaching the variety *cycanocephala* so far only recognized from the west. Occasional specimens appear entirely immaculate, but a bath in chloroform or benzine removes the grease and usually shows at least a trace of the short middle band.

Douglas, Lawrence, McPherson, Argentine, Kansas; Denver, March 26 (Ellis), Colorado; Imboden, April 26 (Marshall), Hope, November (Knobel), Arkansas; Lexington, October (Birkmann), Texas; Asheville, May 19, North Carolina; Mount Vernon, April-May and September (Shoemaker, Nicolay), Virginia; Kingfisher, Oklahoma; Willard, March, Missouri; Nebraska.

var. *cycanocephala* Varas, 28-239 (*amoena* ≠ Harris, 11-8)

This is the *amœna* of Harris and of the Leng list. The mistake occurred by temporarily incorrect labeling of the type in the LeConte collection in Cambridge after his death. We understand that the mistake has been corrected and consequently the type of *amœna* to-day checks with LeConte's description and is a synonym of *limbalis*. This discrepancy of type and description greatly puzzled Mr. Edward Harris.

Cycanocephala differs from *splendida* in that the middle band is sinuate and markings are usually quite broad and complete as in *C. limbalis*. The head and thorax are usually a beautiful French blue but green is quite often met with also. This variety has the same relationship to *splendida* that *C. limbalis* has for its variety *transversa*.

Omaha, April, Lincoln, Malcolm, March through May (Oertel) Nebraska; McPherson, March (Knaus), Topeka (Smyth), Argentine, April, Kansas.

var. *ludoviciana* Leng, 02-131.

A very local and evidently quite rare variety. Markings about as in *splendida*. Possibly the average is less maculated, consisting of merely a small transverse dash at middle and a transverse

apical dot. This is the first of the four varieties of *splendida* having the elytra green. The head, thorax and side margins of the elytra are blue giving the form a very pretty appearance.

Miss Louise Knobel reports that this variety flies much further and faster than *splendida* when disturbed. It is also much rarer and whereas *splendida* can be found in great numbers at Hope, Arkansas, during October and November, one is lucky to get two or four *ludoviciana* during a season's collecting.

Hope, October through November (Knobel), Arkansas; Vowells Mill, April and September (Coverdale), Louisiana.

var. **propinqua** Knaus, 22-194 (*arida* Davis, 28-65)

Light green usually with slight golden sheen. Legs and thorax (except top) covered with a dense, white, erect vestiture. Elytra immaculate except usual transverse apical dot; one specimen has very small humeral dots; dull not shining. Length 9 mm., width 3.5 mm. As mentioned in the original description, the variety is very close to *denverensis* and is incorrectly placed in the *tranquebarica* group by Dr. Walther Horn. The authors are much indebted to Mr. Warren Knaus for sending us his unique type for inspection as well as a paratype of *Cicindela arida*, proving it to be a synonym. In his description of *arida*, Davis remarked that "it was apparently in *tranquebarica* group," but the black palpi of male, deeply granulate punctate elytra and general appearance prove its association with *purpurea*.

Ash Meadow, Nye Co., August 16 (Nininger and Hoover), Nevada; Death Valley Junction, March 31 (Gunder), California.

var. **denverensis** Casey, 97-297 (*graminea* ≠ Casey, 13-21; *conquisita* Casey, 14-357; *oreada* Casey, 14-358)

Larger and with a longer body than *propinqua*. Vestiture of thorax less dense and long. Elytra usually light green, sometimes dark bluish green, dull. Markings consisting of short transverse middle band. Occasionally post-humeral and ante-apical dot present and markings broader (*conquisita* and *oreada*). Although considered as an "abundantly" distinct species by Colonel Casey, *denverensis* may be traced through *ludoviciana* as merely another variety of *splendida*.

Denver, April and May, Colorado; Sioux County, Nebraska; Kansas.

var. *pugetana* Casey, 14-20.

Differs from the two preceding green varieties in that the head and thorax are much less densely pubescent. Middle band is distinctly sinuate. Green of elytra more shiny and brighter, not dull as in *denverensis* and *propinqua*. Casey also considered the black palpi as of some significance but as he described *pugetana* from a single example this can not be accepted until more material is available. *Pugetana* is spelled "*pugitana*" on the type, which is a small male. Specimens collected by Mr. Gibson and sent to the senior author through the kindness of Mr. C. A. Frost are larger, possibly because they come from farther south (Washington). One of the three specimens has the lunule missing. Known from the Northwest.

British Columbia; Buena, April 13 (Gibson), Washington. Also listed from Montana, Idaho and Wyoming by Dr. Walther Horn.

C. decemnotata Say, 17-19 (*lantzi* E. D. Harris, 13-68; *albertina* Casey, 13-24)

Dull green, usually tinged with cupreous. Markings broad and heavy, middle band very long and suddenly bent. Thorax rather hairy. Some specimens have the dull green of the elytra margined with bright green or blue. Specimens sent by Mr. F. S. Carr from Medicine Hat, Alberta, are remarkably constant as to size, color and markings. Some forms are found, however, in which the humeral and post-humeral dots are missing and more rarely the middle band may be reduced to a marginal spot thus approaching *pugetana* and along with the placement of the hairs proving its connection with *splendida* and the whole *purpurea* group.

Recorded from Alaska to Wyoming, Nebraska, Utah, Kansas and California. Medicine Hat, April 21-26 (Carr), Alberta, Canada.

C. cimarrona Lec., 68-49.

Easily told from all other species and varieties by the distinct marginal lines of the elytra and the short and abrupt branches,

indicating the usual humeral lunule, middle band and apical lunule. Color black to a dull green, usually with a coppery lustre.

Jemez Springs, July 24, New Mexico; Creede, August, 8844 feet (Hunter), Colorado, also Arizona and Southwest Utah.

* * *

C. tanneri (Jour. Kansas Ent. Soc., Vol. 2, No. 2, April, 1929, pp. 47-48) was described by Knaus as being very close to *willistoni* and therefore should not be placed as a phase or variety of *C. decemnotata* as is done by Dr. Walther Horn with a question mark.

BIBLIOGRAPHY

- BATES, H. W. 1881-84. *Biologia Centrali-Americana*, Insecta. Coleoptera. vol. I, part I.
- BLATCHLEY, W. S. 1910. *Coleoptera of Indiana*.
- BRADLEY, J. C. 1930. *A Manual of the Genera of Beetles of America North of Mexico* (Ithaca).
- CASEY, T. L. 1897. *Coleop. Notices VII.* (Ann. N. Y. Acad. Sci. IX, 1897, pp. 285-684).
- CASEY, T. L. 1909. *Studies in the Caraboidea and Lamellicornia* (Canad. Ent. Aug. 1909).
- CASEY, T. L. 1913. *Cicindelidæ and Carabidæ.* (Memoirs on the Coleoptera IV. Lancaster, 1913, pp. 1-192).
- CASEY, T. L. 1914. *Omus and Cicindela.* (Memoirs on the Coleoptera V. Lancaster, 1914, pp. 1-24).
- CASEY, T. L. 1916. *Memoirs VII.*
- CASEY, T. L. 1920. *Memoirs IX.*
- CASEY, T. L. 1924. *Memoirs XI.*
- DAVIS, A. C. 1928. *A New Cicindela* (Coleoptera, Cicindelidæ). (Pan Pac. Ent. vol. 5, pp. 65-66).
- FABRICIUS, JOHANN C. 1801. *Systema Eleutheratorum*, Kiliae, 1801, 2 vols.
- HARRIS, E. D. 1911. *List of North American Cicindelidæ* (Yonkers).
- HARRIS, E. D. 1913. *Three New Cicindelids* (Jour. N. Y. Ent. Soc. XXI, 1913, pp. 67-69).
- HARRIS, E. D. and C. W. LENG. 1916. *The Cicindelinae of North America as arranged by Dr. Walther Horn.*
- HENTZ, N. M. 1830. *Description of Eleven New Species of North American Insects* (Trans. Am. Phil. Soc. ser. 2, III, 1830, pp. 253-258).
- HORN, W. 1908. *Genera Insectorum, Cicindelinae.*
- HORN, W. 1930. *Cicindelidæ of America North of Mexico* (Trans. Amer. Ent. Soc. LVI, 73-86).

- KLUG, JOHANN C. F. 1834. *Jahrbücher der Insectenkunde*, etc. (Berlin, 1834).
- KNAUS, W. 1922. Two New Forms of *Cicindela* with Remarks on Other Forms (*Jour. N. Y. Ent. Soc.* vol. XXX, p. 194-197).
- LECONTE, JOHN L. 1845. Descriptions of Some New and Interesting Insects Inhabiting the United States (*Bost. Jour. Nat. Hist.* V. 1845, pp. 203-209).
- LECONTE, JOHN L. 1848. A Descriptive Catalogue of Geodephagous Coleoptera (*Ann. Lyc. Nat. Hist. N. Y.* IV, 1848, pp. 173-474, pl.).
- LECONTE, JOHN L. 1857. Revision of the *Cicindelæ* of U. S. (*Trans. Am. Philos. Soc.* (2), XI, pp. 27-63).
- LECONTE, JOHN L. 1868. New Coleoptera from Survey Kansas, N. Mexico (*Trans. Am. Ent. Soc.* II, 1868, pp. 49-59).
- LENG, C. W. 1902. Revision of the *Cicindelidæ* of Boreal America (*Trans. Amer. Ent. Soc.* XXVIII).
- LENG, C. W. 1918. A New Race of *Cicindela* with Notes on Other Races and Species (*Jour. N. Y. Ent. Soc.* Vol. XXVI, pp. 138-141).
- LENG, C. W. 1920. Catalogue of the Coleoptera of America, North of Mexico and Suppl. 1927.
- LINNÉ, CARL VON. 1758. *Systema Naturæ*, ed. 10, Holmiae, I, 1758; II, 1759.
- OLIVIER, ANTOINE G. 1790. *Entomologie* II, Paris 1790, 485 pp., 63 pl.
- SAY, THOMAS. 1817. *American Entomology*, vol. 1, No. 1, Phila. 1817.
- SCHAUPP, F. G. 1883. *Syn. Tables Cicindelidæ* (*Bull. Br. Ent. Soc.* VI, 1883, pp. 73, 85, 97, 121, pl.).
- SCHAUPP, F. G. 1884. Synopsis of the *Cicindelidæ* of the United States of North America (*Bull. Brook. Ent. Soc.* vol. 6).
- SHELFORD, V. E. 1917. Color and Color-Pattern Mechanism of Tiger Beetles (*Ill. Biol. Mon.* vol. III. No. 4, April, 1917).
- TANNER, V. M. 1929. The Coleoptera of Utah—*Cicindelidæ* (*Pan Pac. Ent.* vol. 21, No. 2).
- VARAS, E. A. 1927. Third Contribution to the Study of the *Cicindelidæ*, group *purpurea-oregona*. (*Revista Chilena de Historia Natural*, XXXI, pp. 173-175).
- VARAS, E. A. 1928. Fourth Contribution to the Study of the *Cicindelidæ*, group *formosa, purpurea, oregona*. (*Revista Chilena de Historia Natural*, XXXII, pp. 231-250).
- VARAS, E. A. 1929. Contributions to the Study of the *Cicindelidæ*, group *oregona*. (*Revista Chilena de Historia Natural*, XXXIII, pp. 394-402).
- WICKHAM, H. F. 1899. Habits of American *Cicindelidæ* (*Davenport Acad. Nat. Sci.*).

THREE NEW SPECIES OF EXPTOCHIOMERA FROM THE UNITED STATES (HEMIP- TERA-LYGAEIDÆ)

BY H. G. BARBER

U. S. BUREAU OF ENTOMOLOGY

Exptochiomera intercisa new species

Color pale castaneous, subshining; apex of scutellum, narrow costal margin anteriorly, inner field of the corium longitudinally, and preapical fascia stramineous; posterior lobe of pronotum obscurely testaceous and provided with three obscure, broad, castaneous bands; basal and terminal segments of antenna castaneous, second and third segments and legs testaceous, femora preapically and tibia basally somewhat infuscated; membrane sordid white with several elongate brownish spots at base and apex. Beneath castaneous; pleura subshining; venter dull.

Head as long as wide, rather closely punctate, sparsely covered with fine incumbent hairs, eyes rather large; preocular lateral margins of head slightly diverging, rather long, one-third shorter than length of eye; ocelli twice as far apart as each is remote from eyes. Antenna finely pilose; the long incrassate basal segment exceeding apex of head by one-half its length; second segment about one-third longer than first, third one-half the length of second, and the fusiform fourth a little longer than basal; relative length of segments in millimeters as follows: I-.44, II-.64, III-.50, IV-.56. Rostrum long, reaching to the posterior coxæ, basal segment one-fourth longer than basal segment of antenna, second segment equally as long, third a little shorter than second. Pronotum almost one-third wider than long; anterior lobe about two and one-half times longer and much narrower than posterior lobe; lateral margin rather strongly constricted between the lobes, as viewed laterally this constriction not evident dorsally; anterior lobe more closely and finely punctate, sparsely covered with pale incumbent hairs; lateral margins in dorsal view gently rounded and converging anteriorly; anterior submargin somewhat depressed; posterior lobe very coarsely but not confluent punctate; humeral angles smooth, obtusely rounded; posterior margin before the scutellum gently concavely arcuate. Scutellum scarcely longer than wide, provided with a very distinct Y-shaped, smooth, calloused carina, coarsely punctate along the submargins; depressed disk, within the arms of the carina, more sparsely and finely punctate. Hemelytra with the clavus provided with three regular, parallel rows of punctures; corium with two parallel rows of coarse punctures along the claval suture; elsewhere except along the costal margin and on the somewhat

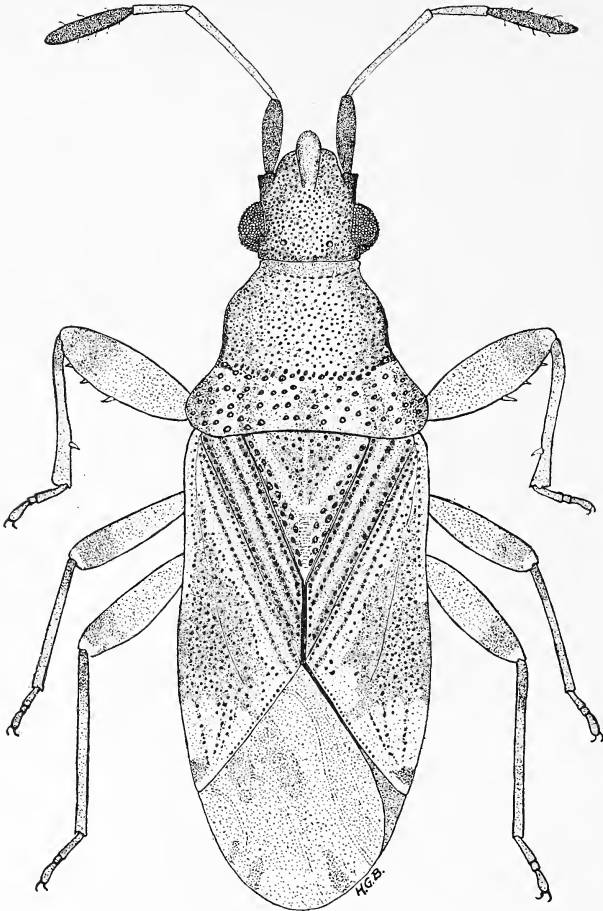


Fig 1. *E. intercosa* n.sp.

elevated mid-vein rather coarsely but sparsely punctate. Pro- and mesopleura rather closely and coarsely punctate; metapleurum more sparsely punctate. Incrassate fore femora armed below with a double series of spines, each with three distinct short spines, longer in the male, the longest pair near the middle, the other two pairs placed almost as equidistant from each other as the preapical one is remote from apex. Anterior tibia of the male, one-fourth the way from apex, armed with a stout, inclined spine which is nearly as long as diameter of that part of tibia contiguous to spine, the inner face provided with a row of minute serrations in both sexes. Basal segment of posterior tarsus a little shorter than second and

third segments united. Venter impunctate, very finely rugulose and provided with a few short, inclined seta-like hairs arranged in transverse rows; lateral opaque glandular spots each furnished with a long delicate hair. Length 4.4 mm.

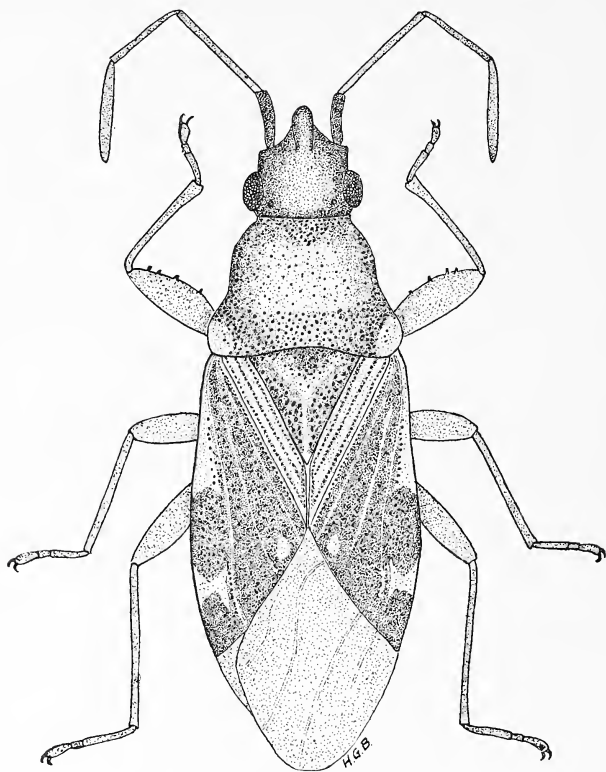
Type male: U. S. N. M. No. 43851, Cayamas, Cuba (E. A. Schwarz). Paratype female: U. S. N. M. No. 43851, "Florida" (Uhler collection labeled *Ligyrocoris intercisus* Uhler).

I have adopted Uhler's MS. name for this species. It is one of the largest members of the genus, being fully as large as *E. minima* (Guer.) but is readily distinguished from that species by the characters given in the key. In the figure of the species the femora are drawn a little too much extended beyond the body.

Exptochiomera arizonensis new species

The fully colored type is dark castaneous, somewhat shining; humeral angles, apex of scutellum, clavus between the rows of punctures, corium with veins, costal margin before the middle, preapical fascia, and a small spot near inner apical angle pale stramineous; antennæ embrowned, basal segment a little darker; legs testaceous with the femora apically, faintly tinged with brown. Beneath dark castaneous, margins of acetabula obscurely, outer apical angle of metapleurum and central disk testaceous. In less deeply colored specimens the head, pronotum, and ventral parts more ferrugineous; corium less deeply castaneous. Membrane lacteous-hyaline, embrowned at inner basal angle.

Head but little wider than long (9:8); apex reaching a little beyond middle point of basal segment of antenna; impunctate, faintly, finely granulose; preocular lateral margins of head about two-thirds as long as length of eye, parallel to each other; ocelli set close to eyes, 6-7 times as far apart as each is removed from eyes; antennae with second segment twice as long as basal one; third about one-third shorter than second and nearly one-third shorter than fourth; relative length of segments in millimeters as follows: I-.32, II-.64, III-.44, IV-.60. Rostrum with apex extending to a point just behind middle coxae; basal segment but slightly shorter than second and distinctly longer than basal segment of antennae; third segment one-third shorter than second. Pronotum three-sevenths wider than long; anterior lobe two-fifths longer than posterior one; lateral margin more gently arcuately contracted between the lobes than in the preceding species; anterior submargin somewhat depressed, closely punctate; lateral submargins of anterior lobe and all of the posterior lobe except the smooth humeral angles coarsely and closely punctate; central disk of anterior lobe finely and sparsely punctate. Scutellum about as long as wide with a distinct Y-shaped, smooth, calloused carina, coarsely punctate along the submargins; the de-

Fig 2. *E. arizonensis* n.sp.

pressed central disk more sparsely, finely punctate. Hemelytra with the clavus provided with three regular parallel rows of punctures; corium with two rows of punctures paralleling the claval suture, elsewhere, except on costal margin and veins, finely and sparsely punctate. Prosternum anteriorly and propleurum posteriorly coarsely, closely punctate; meso- and metapleura very sparsely punctate. Venter impunctate; each lateral opaque glandular spot provided with a long, fine hair. Incurvate anterior femora armed with a single series of four short spines, one near the middle, the other three nearer apex equidistant; anterior tibia mutic; basal segment of posterior tarsus distinctly longer than second and third united. Length 3.6 mm.

Type female: U. S. N. M. No. 43852, Tucson, Ariz., May 31, 1924 (A. A. Nichol). Paratypes males: 2 same data as type; 1 Deming N. Mex., July 12, 1917 (Trap light, H. H. Knight);

females: 2 Tucson, Ariz., May 31, 1924 (A. A. Nichol); 1 Tucson, July 20 (E. A. Schwarz); 1 Tucson, Ariz. (Coll. of H. G. Barber). Type and paratypes in the U. S. National Museum and paratypes in the collection of Prof. H. H. Knight and the author.

This species is readily distinguished from most of the species of the genus by the absence of the tibial spine in the male and the single series of femoral spines. From *fuscicornis* (Stål), to which it is most closely related; it may be separated by the difference in color, the relatively shorter second segment of the antennæ, shorter head, etc.

Exptochiomera nana new species

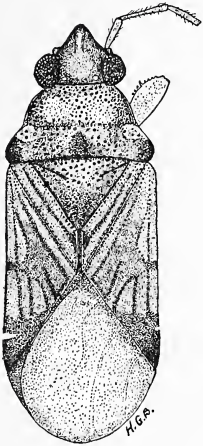


Fig.3 *E. nana* n.sp.

Head, pronotum in part, basal half of scutellum, and inner field of corium ferrugineo-fuscous; humeral angles and middle fascia of posterior lobe of pronotum, apical half of scutellum, hemelytra with lines of punctures on clavus and corium, spot just behind middle of costal margin, and apical angles ferrugineo-castaneous; lateral spot on posterior lobe of pronotum before the humeral angles, clavus, and corium between the veins stramineous; antennae and legs [in part missing] pale testaceous; beneath ferrugineous with central disk of venter somewhat paler. The unique specimen may not be fully colored.

Head one-sixth wider than long, obscurely, finely punctate, and very finely rugulose; pre-ocular lateral margins of head one-fourth shorter than length of an eye; ocelli about four times as far apart as each is remote from eyes; eyes sparsely pilose. Antennae with basal segment short, but little exceeding apex of tylus; second segment two-fifths longer than first and but little longer than third; fourth missing. Rostrum with apex reaching to middle coxæ, first segment not reaching to base of head; second a little longer than basal; third a little shorter than second. Pronotum nearly twice as wide as long (20:11); anterior lobe with lateral margins lightly impressed, nearly one-third longer than posterior lobe (7:5); a faint transverse line separates the two lobes, laterally the constriction between the lobes is gently, concavely sinuate; anterior lobe in front and laterally rather closely and coarsely, the posterior lobe more sparsely, punctate; disk of anterior lobe with a few scattered fine punctures; humeral angles smooth. Scutellum very nearly as long as wide (11:12); closely punctate on basal disk; apically, transversely rugose and sparsely punctate between the rugae; two upper

arms of the Y-shaped carina nearly bisecting the basal angles, the lower arm obsolete. Hemelytra with clavus provided with three parallel rows of punctures; corium with two inner parallel rows of punctures placed next to the claval suture; two other broken series of punctures on the central field of the disk; the costal area set off by a row of parallel punctures. Membrane luteous-hyaline. Prosternum and propleurum anteriorly sparsely punctate; the latter smooth behind the constriction; meso- and metapleura sparsely punctate. Inerassate fore femora armed beneath with a single row of 14 uniform, minute, close set spines, beginning one-third way from base; anterior tibiae missing; basal segment of posterior tarsus somewhat longer than the other two segments united. Length 2.56 mm.

Type male: U. S. N. M. No. 43853, Framingham, Mass., Dec. 1913 (Collected by C. A. Frost).

This unique specimen was received for determination from Dr. Walther Horn, Director of the Deutsches Entomologisches Inst. Kaiser Wilhelm-Gesellschaft, who has kindly presented it for deposit in the National Museum. It was collected by C. A. Frost in sifting at Framingham, Mass. I have hesitated to describe this from a single imperfect specimen but it is so distinct from any other species of this genus that I have decided to include it. The small size, peculiar armature of the fore femora, and the short basal segment of the antennae are distinctive characters.

KEY TO U. S. SPECIES OF EXPTOCHIOMERA

1. Anterior femora armed beneath with a single series of 14 or 15 minute uniform spines. Basal segment of antennae scarcely exceeding apex of head. Small species, 2.56 mm.—(Mass.)..... **nana** n. sp.
- Anterior femora armed beneath with a single or double series of three or four usually unequal spines. Basal segment of antennae much exceeding apex of head..... 2.
2. Fore tibiae of male straight, mutic; head and pronotum nude, subshining; pronotum dorsally not strongly constricted between the two lobes; fore femora armed below with a single series of three or four spines..... 3.
- Fore tibiae of male more or less curved and armed with a preapical spine; head and pronotum either tomentose or sericeous; pronotum dorsally rather strongly contracted between the two lobes; anterior femora armed below with a double series of three or four spines..... 4.
3. Fore femora armed with a row of three short spines; second segment of antennae twice as long as third; head and pronotum each one-third wider than long; humeral angles concolorous—(Tex., Ariz.).
fuscicornis (Stål).
- Fore femora armed with a row of four short spines; second segment of antennae not twice as long as third; head but slightly wider than long;

- pronotum about three-sevenths wider than long; humeral angles pale—
(Ariz., N. Mex.).....**arizonensis** n. sp.
4. Costal margin strongly concavely sinuate before middle; head and pronotum densely tomentose and with numerous, long, semi-erect hairs; anterior lobe of pronotum strongly inflated dorsally—(Ariz., Mex., C. Amer.).....**formosa** (Distant).
- . Costal margin slightly concavely sinuate before the middle; head and pronotum sericeous, without long hairs; anterior lobe of pronotum commonly not strongly inflated dorsally.....5.
5. Terminal segment of antennæ but little longer than basal; disk of anterior lobe of pronotum coarsely and closely punctate, the lateral margins viewed dorsally gently rounded; the transverse stricture between the lobes less obvious, the diameter of which is almost twice as wide as diameter of anterior margin—(Cuba, Fla.).....**intercisa** n. sp.
- . Terminal segment of antennæ much longer than basal; disk of anterior lobe of pronotum sparsely, finely punctate, the lateral margins, viewed dorsally, strongly rounded; the transverse stricture between the lobes strongly impressed, the diameter of which is more nearly equal to diameter of anterior margin6.
6. Head and pronotum more sparsely sericeous, shining; pronotum one-fourth wider than long; antennæ twice as long as pronotum; relative lengths of antennal segments: I-.32, II-.64, III-.40, IV-.60 mm. Larger species, 4.36 mm.—(Fla., Tex., Mex., W. Ind.).
minima (Guér.).
- . Head and pronotum more densely sericeous, dull; pronotum two-fifths wider than long; antennæ plainly not twice as long as pronotum; relative lengths of antennal segments: I-.28, II-.56, III-.36, IV-.52 mm. Smaller species, 3.64 mm.—(Tex., Mex., C. Amer., W. Ind.).
oblonga (Stål).

NEOCLOEON, A NEW MAYFLY GENUS (EPHEMERIDA)*

BY JAY R. TRAVER

Slender nymphs somewhat resembling those of *Baetis* were taken in the early spring of 1929 and again in 1930, from a small spring-fed tributary of Big Alamance Creek, twelve miles south of Greensboro, N. C. These were reared into imagoes in which the hind wing was totally lacking; the intercalaries of the forewing occurred singly, and the genitalia resembled those of *Centropilum*. Since the combination of characters of nymph and imago of these mayflies does not fit any previously-described genus, a new genus *Neocloeon* is herewith proposed, the type species to be *Neocloeon alamance*. This genus would appear to be rather close both to *Cloeon* and to *Centropilum*.

NEOCLOEON genus nov., type species **NEOCLOEON**
ALAMANCE n. sp.

The nymphs of this genus have stream-line-form bodies of the *Baetis* type, and rather long legs. The antennae are rarely longer than head, thorax and the first five abdominal segments in young nymphs, and do not extend beyond the second abdominal segment in mature nymphs. The claws are long, slender and sharp-pointed. The tibia is slightly longer than the tarsus, and the femur equal to twice the length of the tarsus, in the fore-leg. Gills are present on segments 1-7, all single, the tracheae pinnately branched, but all the main branches on the inner side (see Figs. 13-17). The tails are three in number, approximately equal in length and thickness, the two outer ones with long hairs on the inner margin and short spinules out the outer margin. The lateral margins of the abdominal segments are spinose, the posterior spines being somewhat longer than the anterior ones. The maxillary palp is three-jointed. The distal end of the labial palp is much dilated at the tip, its lower angle rounded. Mouthparts in general very similar to *Centropilum* (Figs. 2-6, 9, 11, 12).

Hind wings are lacking in the adult insect, and the intercalaries, as already mentioned, occur singly. As in *Cloeon*, the first cross vein between R and the upper branch of the radial sector is, in the main, basad of the first cross vein in the cell below. But in one wing examined, this first cross vein was distad of the first cross vein in the cell below, as in *Procleocon*.

* Contributions from the limnological laboratory of Cornell University.

Evidently this character is inconstant in *Neocloeon*, and is therefore of no use. Turbinate eyes of the male are not contiguous at any point, but approach one another at the back. The genitalia somewhat resemble those of *Centroptilum conturbatum* McD., the forceps being four-jointed. The second joint of the forceps is expanded on its inner margin into a truncate projection resembling an ax blade. The terminal joints are long and slender; the penultimate joints are swollen distally and to a lesser extent near the basal end, and curve inward. Claws are dissimilar on all legs, in both sexes. The tarsus of the foreleg of the male equals $1\frac{1}{2}$ of the tibia. First tarsal joint very short; second, twice the length of the fourth; third, $1\frac{1}{2}$ the length of the fourth. Tibia approximately $\frac{1}{2}$ the length of the femur. In the second and third legs of both sexes, the first tarsal joint is much elongated, being approximately three times the length of the second joint. The tenth sternite of the female is an irregular plate, cleft along the center line almost or entirely to the posterior margin of the ninth sternite. Laterally, each side of this plate is much narrowed near the base, then expands slightly into a sharp-pointed projection (see Fig. 7). Tails two, in male and female. Tails of male imago slightly more than twice the length of the body.

Of the nymphs of the genera related to *Neocloeon*, the following likewise have single gills: *Baetis*, *Centroptilum*, *Pseudocloeon* and *Acentrella*. The two latter lack a median tail, which at once distinguishes them from *Neocloeon*. The shape and tracheation of the gills, the mouthparts and the approximate equality of the tails, serve to separate *Neocloeon* from *Baetis*. The shape and tracheation of the gills distinguish it from *Centroptilum*.

In three other genera of this group—*Pseudocloeon*, *Cloeon*, and *Procloeon*—hind wings are lacking in the adults. In *Pseudocloeon* the intercalaries are paired, which character separates this genus from *Neocloeon*. *Cloeon* and *Procloeon*, however, have the intercalaries single, as in *Neocloeon*. These may be separated from the new genus by the type of the genitalia, the second joint of the forceps in *Neocloeon* being enlarged and expanded on the inner margin, as already stated. Further, the relative lengths of the joints of the legs differ in each of these genera from *Neocloeon*, as follows: In *Cloeon* (Eaton, p. 180) the fore tarsus of the male is nearly $\frac{1}{2}$ as long as the tibia; the joints of the hind tarsus are, in order of lessening rank, 1, 4, 3, 2. In *Neocloeon* the fore tarsus is but $1\frac{1}{2}$ as long as the tibia, the joints of the hind

tarsus ranking as 1, 2, 4, 3. Procloeon (Bengtsson, p. 219) agrees with Neocloeon in that the first joints of the middle and hind tarsi of both sexes are much elongated, being three times longer than the second joints. The latter, however, are in Procloeon three times longer than the third joint, while in Neocloeon the second joint is less than twice the length of the third joint.

NEOCLOEON ALAMANCE, n. sp.

MEASUREMENTS

	<i>Body</i>	<i>Tails</i>	<i>Wing</i>	<i>Foreleg</i>
Male nymph (3 specimens)	5-6	Broken		
Female nymph (6 specimens)	5½-7	2½-3		
Male imago (5 specimens)	5-6	12-12½	4½-6	4-5
Female imago (5 specimens)	5½-7	Broken	5½-6	3-4

NYMPH (see Fig. 1)

Head.

Compound eyes very dark grey or black. Middle ocellus dark grey; less than half as large as lateral ones, which are ringed at base with dark grey except on upper margin. Antennæ and mouthparts whitish. Genæ and frons creamy white; vertex and occiput same, but with brown longitudinal stripes. Mouthparts much as in *Centropitulum*. Both outer and inner canines of the left mandible have four teeth, although but three are usually visible on the right mandible. The lacinia of the right mandible is a slender curved rod, while that of the left one is larger and has a comb-like projection on the edge away from the canines. A row of hairs is present on both mandibles between the lacinia and the molar surface. Labrum wider than long. End joint of maxillary palp longer than first or second, which are about equal in length. Palp slightly longer than entire body of maxilla.

Thorax.

Dorsally light yellow with brown markings. Pleura creamy; ventrally white.

Legs.

Creamy white. Claws very long and slender, longer than half the tarsus. Tarsus and tibia of second leg of equal length; femur nearly twice as long as tibia or tarsus. Third leg, tibia slightly longer than tarsus; femur 1½ as long as tarsus.

Abdomen.

Tergites light yellow marked with brown. Sternites creamy white, 5-8 with posterior border narrowly brown. Tergites and sternites with short spines fringing the posterior border of each. Lateral margins of abdominal segments spinose. Gills present on segments 1-7, all single, the tracheæ

branching pinnately, but all the main branches on the inner side. First gill more slender than others. Each gill almost straight on outer margin, widely rounded on inner margin, and cordate at base on inner side. (See Figs. 13-17.)

Tails.

Three, the middle one very slightly shorter than the outer ones. All three end in long slender filaments, which are easily broken. Outer tails fringed with hairs on inner side, and with short spines on outer side. Short spines also at some of the joinings. Bare at tips. Tails creamy white, light brown at joinings. In a young nymph, the tails are fully as long as the abdomen.

MALE IMAGO

Head.

Reddish brown. Ocelli white, ringed at base with black. Antennæ greyish tan, second joint white except at joinings. Turbinate eyes bright orange; occupy most of upper half of head (see Fig. 8.). Upper surface somewhat egg-shaped, but inner margin straight. These eyes not contiguous at any point, but closer together near back. Lower portion of compound eyes blue-black, silvery along borders.

Thorax.

Pronotum and prothoracic pleura olive-brown. Mesonotum bright red-brown; light tan on each side of and posterior to central sclerites. Mesothoracic pleura yellowish brown, creamy white between sclerites. Metanotum dark red-brown, metathoracic pleura olive-brown. Venter of thorax dark red-brown shading into olive-brown posteriorly. Creamy white at joinings of sclerites.

Legs.

Silvery white. Foreleg almost as long as body. Tarsal joints in order of decreasing length; 2, 3, 4, 5, 1. Second tarsal joint twice as long as fourth; fifth joint one-half of fourth. Femur $\frac{3}{4}$ of tibia. Tarsal joints of second leg, in order of decreasing length; 1, 4, 2, 3. Fourth joint longer than second or third. Third leg, tarsal joints are; 1, 2, 4, 3. Second and fourth joints equal in length. In second and third legs, first tarsal joint is slightly longer than all other tarsal joints together, and femur is twice the length of the tibia.

Wings.

No cross veins beyond humeral cross vein in basal half of costal cell. All veins silvery white. Wings transparent except in costal and subcostal cells, which are translucent, particularly so in the apical third. (See Fig. 18.)

Abdomen.

Tergite 1 dark olive-brown, with a small rounded silvery spot on each side in posterior lateral angle. Tergites 2-6 silvery, each with light olive-brown band parallel to posterior margin. An extension of this band on each side runs forward, forming triangular patches in each posterior lateral angle. Only in tergite 2 does the apex of this triangle reach the anterior margin.

A longitudinal stripe extends the length of each tergite on each side of the mid-dorsal line, becoming wider posteriorly. Between these two lines, two short darker parallel bars closely border the mid-dorsal line, extending from the anterior margin backward about one-third the length of the tergite. Tergite 7 dark olive-brown. A small silvery triangle in anterior lateral angle; crescent-shaped spots on each side near the pleural fold and in the center of the posterior margin.

Sternite 1 dark olive-brown, lighter near center of posterior margin. Sternites 2-7 silvery; each with white ganglionic area. Small and indistinct in 2 and 3, this area forms a wide central longitudinal streak in 6 and 7. On 2 also, a wide white band runs the length of the sternite on each side of the mid-ventral line, each starting from a round brown spot on the anterior margin. Sternite 8 opaque yellowish white, a faint brownish streak next to pleural fold. Sternite 9 opaque white in center, bordered on sides and along posterior margin with dark olive-brown; white next to pleural fold. Sternite 10 entirely white.

Abdominal segments 2-7 transparent, others opaque. On every tergite a purplish-brown streak lies parallel and near to the pleural fold, in the posterior three-fourths of each.

Genitalia.

Forceps silvery white. Penes inconspicuous. Funnel-like openings of vasa deferentia appear from the dorsal aspect as in fig. 10.

Tails.

Silvery white, opaque white at joinings. Finely pilose throughout length. Slightly more than twice the length of the body.

MALE SUBIMAGO

Very similar to imago, but darker. Tails two, only slightly longer than body.

Head.

FEMALE IMAGO

Antennæ and ocelli as in male. Compound eyes dark blue-black, margined with silver. Head light red-brown.

Thorax.

Light red-brown, slightly darker on ventral surface and at posterior margins of meso- and metanotum.

Legs.

Silvery white.

Wings.

As in male, but longitudinal veins, especially C and Sc, are tinted with light brown.

Abdomen.

Tergites light orange-brown. On each, a lighter streak along mid-dorsal line, this lighter area bordered on each side with an irregular brownish band. On 4 and 5, purplish tracings show the location of the tracheæ. On 6-8 are two irregular dark spots on the posterior margin, one on each side

of the mid-dorsal line. Tergite 10 has two longitudinal brown streaks on each side of the median line, and a brown posterior margin. On each tergite appear the purplish bars parallel to and near the pleural fold, as in the male. Sternites creamy, ganglionic area white. On 3-7, on the outer side of the white central area are two indistinct brownish marks in the anterior half of the sternite. 8-10 faintly flesh-colored.

FEMALE SUBIMAGO

Very similar to imago, but darker. Tails 2, equal in length to the body.

Holotype—♂ imago—Big Alamance Creek, N. C. Reared from nymph Apl. 5, 1929.

No. 1020.1 in Cornell University collection.

Allotype—♀ imago—Same as above. Reared.

No. 1020.2 in C. U. collection.

Paratypes—3 ♂ imagoes—Same as above. Reared.

No. 1020.3-1020.8 in C. U. collection.

The nymphs of these dainty little mayflies were first taken on February 17, 1929. At this time they were not mature. However, by March 7 several showed darkened wing-pads, and a male subimago emerged on March 11. On March 28, over fifty nearly-mature nymphs were taken from the same small tributary, the last of these transforming on April 15. As the season of 1930 was unusually early, nymphs of *Neocloeon* were taken in the same stream, in company with partly-grown nymphs of *Blasurus*, on Jan. 5. The first subimago, a female, emerged on Feb. 7. A single nymph was taken from a small rapid-flowing stream near Spero, N. C., on Meh. 24, 1929. Although much collecting was done in the vicinity of Greensboro as well as elsewhere in the state, in no streams except the two mentioned were nymphs of this species found.

The nymphs were kept indoors in shallow water in Petri dishes, with diaton-covered leaves and plant stems for food. As they fed or moved about in the dish, the luminosity of their ocelli was very noticeable. In quickness of movement these nymphs resemble *Baetis*, *Callibatis* or *Ameletus*. Although many nymphs died, the water seldom seemed to be polluted, nor were the bodies of the dead nymphs often to be found. While no *Neocloeon* nymph was actually seen to feed upon the dead body of another nymph, circumstantial evidence leads to the belief that these

nymphs will take such animal food when the opportunity presents itself. Nor would this be unusual, as *Callibaetis* nymphs have been seen to eat bits of dead tadpoles, and nymphs of *Blas-turus* and *Ephemerella* have frequently been observed feeding upon other dead nymphs.

No adults of *Neocloeon* were taken in the field. Several were successfully reared to maturity indoors, although many nymphs and subimagos died. The usual time for the emergence of the subimago from the nymphal skin was between 9:30 and 11 a. m. One male, emerging from its nymphal skin about 9:45 a. m. on April 13, was seen trying unsuccessfully to complete its transformation at 4 p. m. the same day—a subimaginal period of about 6 hours. In the case of another male, 7 hours were required for this period. Until such time as many others can be reared and records kept of the exact time of their transformation, data on the length of the subimaginal period must remain very incomplete.

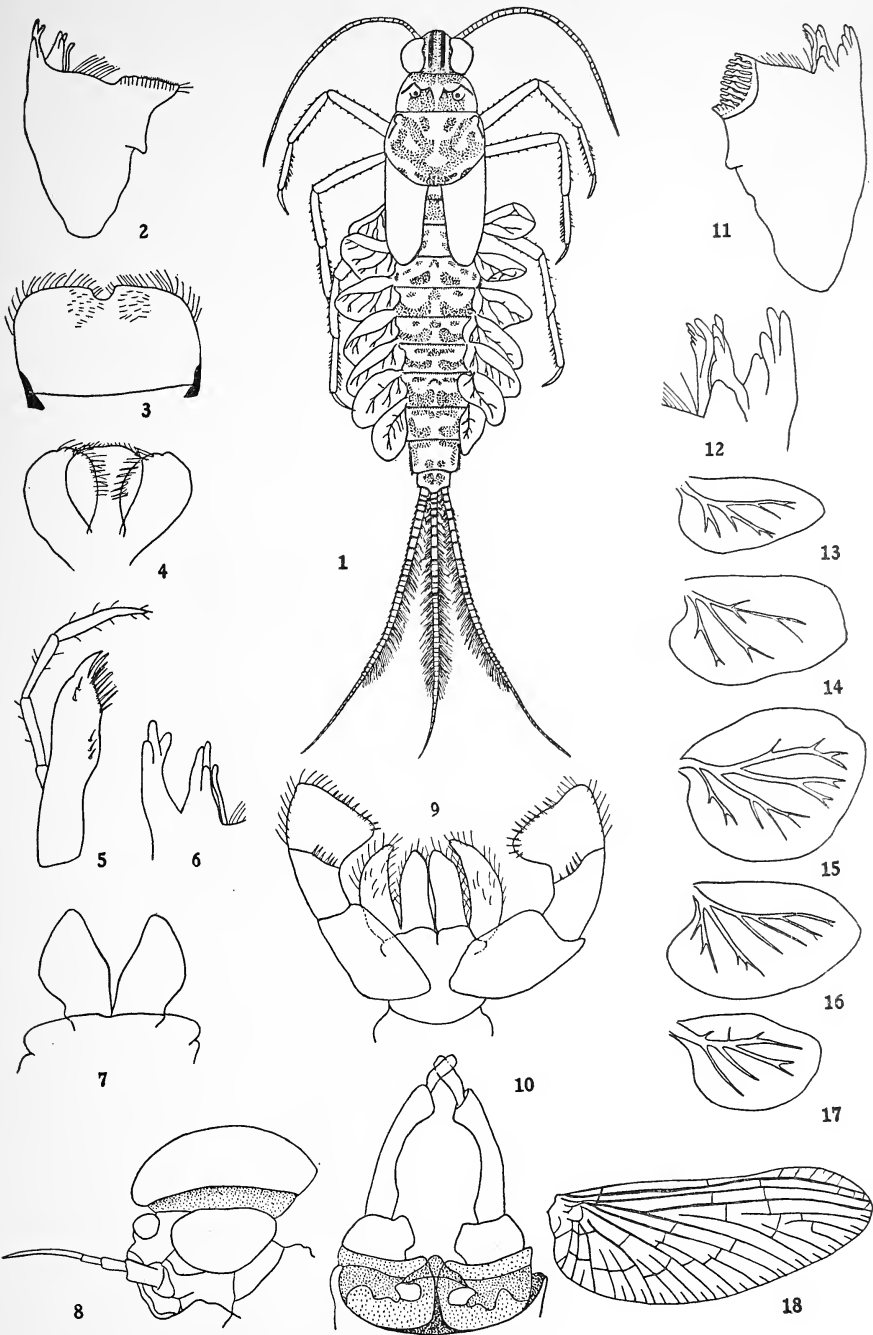
SELECTED BIBLIOGRAPHY

- BENGTSSON, SIMON. 1914-. *Bemerkungen über die Gattung Cloëon*. *Entomologisch Tidskrift*, Årg. 35- H.3-4; pgs. 218-22.
- EATON, A. E. 1883-86. A revisional monograph of recent *Ephemeridæ* or mayflies. *Trans. Linn. Soc. London*, Sec. Series, Zool. Vol. 3; pgs. 173-191; pls. 17, 46, 47.
- MCDUNNOUGH, J. 1929. Notes on North American *Ephemeroptera* with descriptions of new species, II. *Canad. Ent.* 61, No. 8; pgs. 171-173; pl. 3, fig. 6.

PLATE XIV

Neoclæon alamance

- Figure 1. Nymph, not yet fully mature. Dorsal aspect.
Figure 2. Right mandible, ventral aspect.
Figure 3. Labrum.
Figure 4. Hypopharynx.
Figure 5. Right maxilla, ventral aspect.
Figure 6. Detailed sketch of canines, right mandible.
Figure 7. Tenth sternal plates of female imago, with posterior margin of ninth sternite.
Figure 8. Head of male imago, lateral aspect.
Figure 9. Labium.
Figure 10. Genitalia of male imago, dorsal aspect. Basal joint of forceps stippled lightly; chitinized structures stippled more heavily; openings of vasa deferentia unstippled.
Figure 11. Left mandible, ventral aspect.
Figure 12. Detailed sketch of canines, left mandible.
Figures 13-17. Gills from left side of body. In order, taken from segments 1, 2, 4, 5, 7.
Figure 18. Left wing of male imago.



NEOCLEON ALAMANCE

A NEW FORM OF HYLOICUS DISCOVERED IN ECUADOR BY W. JUDSON COXEY

By W. SCHAUS

Hyloicus merops judsoni, new subspecies

Male.—Palpi white mottled with black and fuscous hairs, the tip deep mouse gray; head medially fuscous black, laterally deep mouse gray; vertex and collar dorsally fuscous black, laterally mouse gray; thorax dorsally, and tegulæ outwardly fuscous mottled with white hairs, the tegulæ dorsally fuscous edged by black lines. Abdomen: A dorsal vinaceous cinnamon band with a central, interrupted, black line and faintly crossed by the segmental white lines; subdorsal lateral black patches separated by white segmental lines; abdomen below white thickly irrorated with black and drab, and with some ventral black points. Fore wing purplish gray suffused slightly with drab, chiefly just beyond cell and narrowly below cell antemedially; a black spot at base below cell; the double antemedial and medial black lines less distinct than in *H. merops*; some whitish points on vein 2 from medial to postmedial lines; postmedial lines faint, partly separated by grayish scaling; two obliquely placed white points at discocellular finely edged with black and coalescing; a fine black sinuous line from postmedial to apex; a submarginal sinuous black line outwardly edged with white mottled with dark irrorations; markings of termen as in *H. monjena*. Hind wing black; an antemedial irregular white fascia forming a large black patch at base; a postmedial sinuous white fascia; termen narrowly irrorated with white; cilia white with dark hairs at veins. Fore wing below hair brown slightly irrorated with white, more so on costa, the postmedial black double lines indistinct. Hind wing below with costa to postmedial line broadly mottled white and hair brown; base of inner margin below cell white crossed by an angled black line; postmedial line black, outwardly dentate and broadly edged with white, darkly irrorated on costal half; termen broadly black but narrower at anal angle; some whitish irrorations along margin; cilia white with black spots.

Expanse.—Male 85–98 mm.; female 103 mm.

Habitat: Dos Puentes, Ecuador.

In general appearance this subspecies is much darker than *H. merops* and *H. monjena*, the discal points closer together; in *H. monjena* there is only a single discal point. The black spot at base of hind wing is considerably larger than in the allied forms.

Type Cat. No. 34480, U. S. N. M.

Cotypes in Academy of Natural Sciences, Philadelphia.

THE FOOD OF BATRISODES GLOBOSUS (LEC.), (COLEOP.: PSELAPHIDÆ)*

BY ORLANDO PARK

DEPARTMENT OF ZOOLOGY, UNIVERSITY OF ILLINOIS

A colony of *Lasius niger alienus americanus* Emery was found in a broad, dry board on August 17, 1931, in the sunlit margin of a hemlock forest, on Razorback Lake, near Sayner, Wisconsin. The colony yielded workers in abundance, eggs, larvæ, many pupæ and freshly pupated "callows." With the ants were taken four males and four females of the myrmecocole, *Batrissodes globosus* (Lec.).

Since the exact food of this species appears to be in doubt, the beetles and a part of the colony were studied to determine this point if possible. The general method of observing the nest inhabitants was that used previously (Park, 1929).

B. globosus has been reported previously by Schwarz (1890) with *Lasius alienus*, *Crematogaster lineolatus* and *Camponotus pennsylvanicus*. It has also been found in numbers with *Formica ulkei* (Holmquist, 1928; Park, 1929), so that it appears to have a wide range of formicid hosts.

In 1929 the writer failed to observe this pselaphid feeding. However, it is now certain that *B. globosus*, sharing the protection of the host's nest, and unmolested by the latter, feeds upon their brood.

Living host larvæ, dead and discolored larvæ, and thirdly larvæ which were experimentally crushed and mangled were offered to the pselaphids. All were attacked eventually, although the beetles did not show a tendency to eat every day. Occasionally they fed on two consecutive days, but more often feeding occurred every other day.

The mangled larvæ, with gaping wounds and droplets of exuded body fluid, were most stimulating to the beetles. The

* I am greatly indebted to Dr. M. R. Smith, and to Mr. Thomas Park for the identification of the host ants used in this short study.

uninjured, living larvæ were least stimulating as demonstrated by vigor of attack and length of time feeding. The exuded droplets of the mangled larvæ were summarily licked or bitten. The uninjured larvæ and dead, discolored ones were attacked at any portion of the larval integument. The beetles nibbled the surface or picked up a fold of the larval skin between their sharp mandibles. This fold would be held and crushed until the jaws just barely penetrated the surface, and then these tiny punctures or pits would be licked.

The beetles usually wandered over or near the larvæ for some time before eating. While quartering back and forth, they waved their antennæ and twirled their palpi as they appeared to do continually when active in the artificial nests. Usually one beetle fed alone, but two were often seen eating the same larva. Rarely, more than two fed together. Frequently, a beetle would drag a host larva into a crevice, or attempt to do so. Several times two pselaphids were to be seen pulling at opposite ends of the same larva, until one desisted and wandered away. Duration of feeding varied from desultory biting for five seconds to deliberate eating for as long as ten minutes. In general *B. globosus* fed less often, less voraciously and there were fewer beetles eating jointly than was found for the carabid, *Tachyura incurva* (Park, *loc. cit.*).

From these observations we may infer that this pselaphid may on occasion act as a predator, attacking living host larvæ, but more frequently as a scavenger aiding in the disposal of dead larvæ. This is in agreement with the observations of Donisthorpe (1927) who observed *Batrisodes delaportei* Aubé carrying young larvæ of *Acanthomyops brunneus* in their mouths.

LITERATURE CITED

- DONISTHORPE, H. ST. J. K. 1927. The guests of British ants. London: George Routledge and Sons.
- HOLMQUIST, A. M. 1928. Notes on the life history and habits of the mound-building ant, *Formica ulkei* Emery. Ecology, 9: 70-87.
- PARK, ORLANDO. 1929. Ecological observations upon the myrmecocoles of *Formica ulkei* Emery, especially *Leptinus testaceus* Mueller. Psyche, 36: 195-215.
- SCHWARZ, E. A. 1890. Myrmecophilous Coleoptera found in temperate North America. Proc. Ent. Soc. Wash., 1: 237-247.

FIVE SERICINE BEETLES¹

BY ROBERT J. SIM

CHIEF ILLUSTRATOR, DIVISION OF JAPANESE AND ASIATIC BEETLE RESEARCH,
U. S. BUREAU OF ENTOMOLOGY

Two oriental species of sericine beetle (family *Scarabaeidae*) have become established in the eastern part of the United States. These superficially resemble certain native American beetles, and one of them is similar in appearance to a common *Serica* of Europe. With these facts in view, it seems advisable to prepare a brief illustrated paper which may enable beetle students to distinguish easily insects which have been frequently misidentified. Instead of befogging the subject with a complete and minute description of each species, I shall attempt to make identifications possible by pointing out the prominent distinctive characters in each. It should be emphasized that, while these beetles bear external resemblances to one another, the male genitalia are quite different and should be examined in all careful determinations.

Of the more than forty named species of *Serica*, the smallest (*S. trogiformis* Uhler) is about 0.20 inch (5.08 mm.) long; one of the largest (*S. fimbriata* Lec.) is 0.40 inch (10.16 mm.) or more in length. The majority are medium-sized. Numerous species common in various localities, east and west, are still unnamed.

In form the sericines are oval or oblong in outline as seen from above. The pronotum appears short in relation to the length of the elytra. As viewed from the side, the beetles are thick and are noticeably convex above. The hind femora are thin but wide, as is frequent with insects which progress by leaps. The sericines, however, while nervous and jerky when disturbed, are not to be classed with the true jumpers, such as flea-beetles, grasshoppers, etc. In colors the species range from light yellowish-brown to deep browns and black. Some are shining above while others

¹ Contribution No. 99, Japanese Beetle Laboratory, Moorestown, N. J.

are opaque and velvety in appearance, or even more or less iridescent. In all, the elytra have numerous longitudinal sunken lines rather evenly spaced and marked with small punctures. Most of the species are crepuscular or nocturnal, but a few are active during the daytime.

Beetles of the genus *Diplotaxis* are somewhat similar in form and habits but are less convex, lack the evenly spaced elytral striae, and have less noticeably expanded hind femora.

The present paper discusses five sericines: two native species of *Serica*, one which has been introduced from the Orient, one common in Europe, and one *Autoserica* introduced from the Far East.

THREE DARK SPECIES

1. *Serica sericea* Ill.

Range: United States and Canada.

Length: 0.38 inch (9.65 mm.). Form ovate-oblong.

Color above: blackish-brown; elytra opaque, in clean, matured specimens with a decided iridescent (changeable) sheen. Prothorax sometimes shining.

Elytral striation pronounced.

Clypeus gently convex but with a narrow transverse submarginal concavity. Clypeal suture strongly arched, subangulate at middle. Clypeus and frons each anteriorly with a transverse row of fine, dark, inconspicuous setae.

This is our largest dark *Serica*. Light (*i.e.*, teneral) specimens might be mistaken for *Autoserica castanea*, but the head characters are sufficiently different.

2. *Autoserica castanea* Arr.

Introduced from the Orient. Range in America, Eastern States.

Length: 0.35 inch (8.89.). Form ovate.

Color above: dull chestnut brown, somewhat opaque and with a faint iridescence.

Elytral striation less pronounced than in *S. sericea*.

Clypeus with a median longitudinal convexity reaching anterior reflexed margin. Clypeal suture arcuate,

scarcely subangulate at middle. A few conspicuous, yellowish, erect setae in an irregular transverse patch at middle of frons.

More robust than *S. sericea*. Never blackish. The vaguely roof-like longitudinal ridge of the clypeus and the rather coarse pale hairs on the forehead distinguish this species. Frequently found in immense numbers in gardens and nurseries of the New York and Philadelphia districts and becoming abundant elsewhere.

3. *Serica parallela* Csy.

Range: Eastern, Atlantic and Middle States.

Length: 0.32 inch (8.13.). Form oblong.

Color above: bright chestnut brown, opaque, sometimes faintly iridescent.

Elytral striation similar to that of *S. sericea*.

Clypeus with a roundish central convexity and scattered inconspicuous dark setae. Suture strongly arched, subangulate at middle.

Frons anteriorly with an irregular row of dark inconspicuous setae.

Like a small teneral specimen of *S. sericea*, but with sides more nearly parallel (not expanding posteriorly) and slight, when any, iridescent sheen. Common in pine-oak regions of the Atlantic States.

TWO LIGHT SPECIES

1. *Serica similis* Lewis

Introduced from the Orient. Range in America, parts of Long Island.

Length: 0.32 inch (8.13 mm.). Form elongate. Prothorax noticeably short, with sides not strongly arcuate near apical angles.

Color above: yellowish-brown, opaque throughout. No iridescent sheen.

Elytral striation rather pronounced.

Clypeus with median convexity more evident than in *S. brunnea* but not roof-like as in *A. castanea*. Suture

strongly arched, subangulate. Setae very few, dark and inconspicuous.

The distinctly arched clypeal suture and the shorter pronotum with less arcuate sides differentiate this introduced species from *S. brunnea*, of Europe, which it generally most resembles. The male genitalia of these two beetles are utterly dissimilar and, as in all sericines, should be examined in any doubtful specimen.

2. *Serica brunnea* L.

Range: Europe. Not yet found in America.

Length: 0.32 inch (8.13 mm.). Form elongate. Prothorax with sides usually distinctly arcuate anteriorly.

Color above: rufous to yellowish-brown. Somewhat opaque.

Elytra with a scarcely perceptible iridescent sheen.

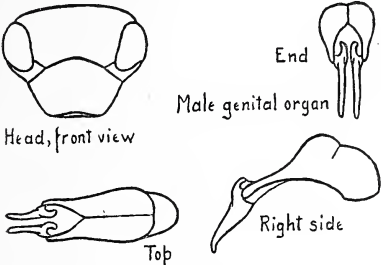
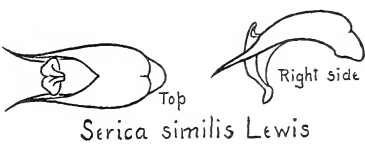
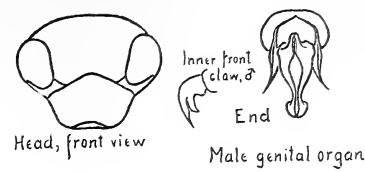
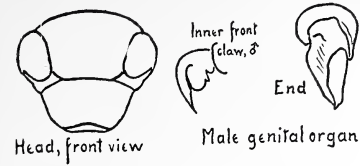
Elytral striation not very pronounced.

Clypeus vaguely convex. Suture nearly straight. Setae few, dark and inconspicuous.

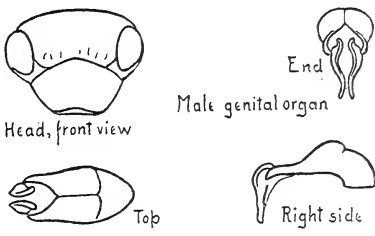
This foreign species might be confused with *S. similis*, but the almost straight clypeal suture and slightly darker color should serve to distinguish it. The pronotum is a little less shortened and its lateral outlines more curved. Specimens examined are from Sweden, England, France, Germany, and Austria.

Dr. E. A. Chapin has called my attention to the claw characters in the males of *brunnea* and *similis*. In the European species (*brunnea*) the tooth of the inner claw on the fore-foot has a noticeable rounded expansion, while in *similis* this tooth is of the usual obliquely truncate type. These clay characters are shown in the accompanying plate of sketches.

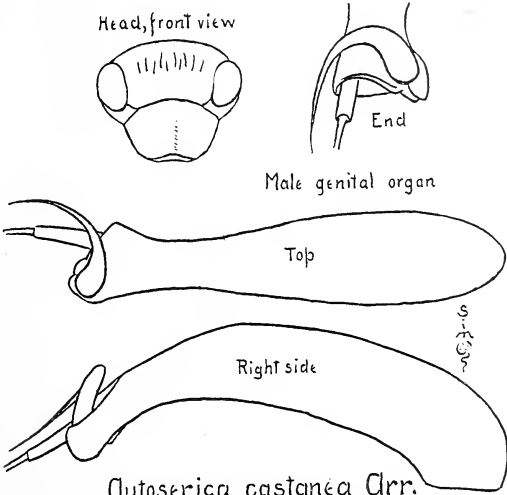
It was reported by Charles Schaeffer last year that several specimens of *S. brunnea* were collected at Flushing, Long Island (Bulletin of the Brooklyn Entomological Society, Vol. XXVI, Oct., 1931); but subsequently these were found to be *S. similis*, and Mr. Schaeffer has written me that this record is being corrected in a later issue of the same publication.



Serica sericea Ill.



Serica parallela Csy.



Autoserica castanea Arr.
SERICINE BEETLES

NEW RECORDS OF LEPIDOPTERA FROM NEW YORK

BY ALEXANDER B. KLOTS

UNIVERSITY OF ROCHESTER

The following records are mostly additions to the "New York State List of Insects" resulting from the author's collecting during 1931. A few records of unusual interest have been included, however, even though they do not constitute definite additions to the State List.

Entomologically at least, 1931 was a very interesting year. The Spring came rather later than usual to Ithaca, with one or two late cold waves. Presumably as a result of these cold spells adults of the leaf-mining Lepidoptera were extraordinarily scarce. Where in a normal year one would be able to collect hundreds of specimens of such genera as *Nepticula*, *Bucculatrix*, *Lithocolletis*, *Parctopa*, *Acrocercops*, etc., scarcely fifty specimens of all such were taken, and it was not until June that the season became more normal.

In listing the records the following abbreviations have been used: "state" signifies that the record is of a species not hitherto recorded from New York; "local" signifies that the record is from a locality in New York from which the species has not hitherto been recorded; !! signifies a record merely of unusual interest.

Family INCURVARIIDAE

- !! *Incurvaria russatella* Clem. McLean, 6 & 12 Jl. Very common in damp woods.

Family NEPTICULIDAE

- "state" *Obrussa ochrefasciella* Chamb. Ithaca, 26 Jl.

Family PSYCHIDÆ

- "local" *Solenobia walshella* Clem. McLean, 15 & 20 May.

Family LYONETIIDÆ

- "local" *Bedellia somnulentella* Z. Ithaca, 4 Aug.
"local" *Philonome clemensella* Chamb. Ithaca, 25 Je.

Family GRACILARIIDÆ

- “local” *Lithocolletis crataegella* Clem. Ithaca, 5 Aug.
“local” *L. ostensackenella* Fitch. Ithaca, 3 Je.

Family OECOPHORIDÆ

- “local” *Agonopteryx canella* Bsk. Ithaca, 30 Je.
“local” *A. lythrella* Wlsm. Ithaca, 15 Jl.
“local” *Semioscopis aureorella* Dyar. McLean, 5 Apr. Very fresh specimens.

Family GELECHIIDÆ

- “state” *Symmoca novimundi* Bsk. Ithaca, 31 May & 27 Jl.

Family LAVERNIDÆ

- “state” *Chrysopeleia purpuriella* Chamb. Ithaca, 16 Je. 1930.
“state” *C. ostryaeella* Chamb. Ithaca, 25 Je. 1931.

Family YPONOMEUTIDÆ

- “local” *Plutella porrectella* L. Clark Reservation, near Jamesville, 16 May.
“local” *Argyresthia conjugella* Z. McLean, 27 May.

Family GLYPHIPTERYGIDÆ

- “state” *Glyphipteryx saurodonta* Meyrick. McLean, 21 Sept. 1930; there is also a specimen in the Cornell University collection from McLean, 31 Aug. '25.

Family TORTRICIDÆ

- “local” *Epinotia lindana* Fern. Rochester, 17 Sept.
“state” *Olethreutes malachitana* Z. Ithaca, 4 Aug.
“local” *O. duplex* Wlsm. McLean, bred from *Populus tremuloides*; emerged, 10 Je.
“local” *O. hebesana* Wlk. Rochester, 17 Sept.
“local” *Cymolomia cornana* Hein. McLean, bred on *Cornus paniculata*; emerged, 24 Je.
“local” *Polychrosis yaracana* Kf. McLean, 27 May.
“local” *Cnephasia argentana* Clem. Ithaca, 19 Je.
“local” *C. listerana* Kf. Ithaca, 14 Jl.

Family **THYRIDIDÆ**

"local" *Thyris maculata* Harr. McLean, 14 Je.

Family **THYATIRIDÆ**

"local" *Habrosyne rectangula* Ottol. Ithaca, 17 Je. 1930; 14 & 22 Je. 1931. May have been imported from Long Island in nursery stock planted on the campus.

Family **GEOMETRIDÆ**

"local" *Stammodes gibbocostata* Wlk. Egypt, 13 Sept. Very common on tree trunks in shaded woods.

Family **NOTODONTIDÆ**

!! *Dasylophia thyatiroides* Wlk. Ithaca, 5 Je. There have been no records since 1883.

Family **LIPARIDÆ**

"local" *Olene pini* Dyar. Ithaca, 14 Jl.

Family **NOCTUIDÆ**

"local" *Parahypenodes quadralis* B. & McD. Ithaca, 26 Jl.

"local" *Abrostola ovalis* Gn. Ithaca, 5 Je. There is also a specimen in the Cornell University collection from Ithaca, 8 Aug. '27, coll., by W. T. M. Forbes.

"local" *Autographa biloba* Steph. Rochester, 16 Sept.

"local" *Acronycta leporina vulpina* Grt. Ithaca, 16 Je.

"local" *Noctua phyllophora* Grt. McLean, 12 Jl. A specimen found drowning in a pitcher plant was given a more scientific if not more pleasant death.

Family **ARCTIIDÆ**

"local" *Apantesis virguncula* Kby. Ithaca, 19 Je.

Family **LYCÆNIDÆ**

"local" *Strymon acadica souhegan* Whitn. McLean, Bog B, 14 Jl.

Family **NYMPHALIDÆ**

"local" *Phyciodes batesii* Reak. Elmira, 12 Je. Abundant.

BOOK NOTICE

REVIEW OF GAGE'S "THE MICROSCOPE," ULTRA-VIOLET,
15TH EDITION

The Microscope. By Simon Henry Gage, Emeritus Professor of Histology and Embryology, Cornell University, Ultra-violet (15th edition). Ithaca, N. Y., Comstock Publishing Company, 8vo., 589 pp., 291 figures, plates, 1932, \$4.00.

A new revised edition of a standard reference work is always welcome. This is particularly true when, as in this instance, there has been added a wealth of new and important information. Previous editions of this work have long occupied an honored place in many of the foremost biological workshops, and are of an excellence too well known everywhere for space here to be given to an outline of their contents. This new ultra-violet edition of the book, which has just appeared from the press, bids fair to supersede in usefulness all those previously issued. For this revision the entire work has been reset, obsolete illustrations replaced, the subject-matter revised, rearranged, and brought down to date. Probably the more outstanding changes in this revision have been the addition of most recent information on the ultra-violet microscope and its use, and on the technique of using ultra-violet radiation in the study of living fresh and fixed tissue; and in the study of living organisms. This section, like the remainder of the volume, is fully illustrated, and the apparatus and methods are described with a fullness that will enable teachers and research workers readily to install and use the required apparatus. Especial emphasis also has been placed upon the technique of what might be termed "the physical analysis of structure" by means of the dark field, the ultra-violet, and the polarizing microscope and the microspectroscope. In this edition changes have been made and material added on the historical development of the microscope. It is evident that a work of this kind, unlike an original monograph, must be largely a compilation; therefore the aid of stu-

dents and associates has been enjoyed and acknowledged. Of particular helpfulness is the very full and complete bibliography, occupying pages 555 to 566, which would enable the student not only to become informed concerning the latest literature on the subject but would also enable him to make a historical survey of its development. The format of the book is excellent, though it is regretted that the publishers used plain cloth binding instead of some form of keratol, buckram or other moisture-proof binding, as this would have been much more efficient for a volume intended for constant use in the midst of the disorder of waste liquids on a laboratory table. An immense lot of toil and pains has been given to the preparation of this work and it, like its predecessors, is certain to possess a wide usefulness.—J. S. WADE.

“NECROPHORUS” OR “Nicrophorus”

BY MELVILLE H. HATCH

Mr. Josef Hlisnikowski (Coleop. Cent. VI, 1932, p. 24) states that “Fabricius in Syst. Entom. 1775, p. 71, selbst *Necrophorus* schreibt und erst später *Nicrophorus*,” thus justifying the use of the form “*Necrophorus*.” This is not the case. Fabricius (*l.c.*) used the form *Nicrophorus*, repeated it in Ent. Syst. I (1), 1792, p. xiii, 246, and did not use the form “*Necrophorus*” until Syst. Eleuth. I, 1801, p. xiv, p. 333, although the form “*Necrophorus*” had been used three years previously by Illiger, Verz. Käf. Preussens 1798, p. 352.* “*Necrophorus*” is an emended spelling. There is wide-spread authority for the use of such an emended spelling, but it should not be put forth in the guise of priority.

The following corrections should be noted in my “Studies on the Silphinae,” Jour. N. Y. Ent. Soc. XXXV, 1927, p. 331-371:

Page 334, line 15, under “I²,” insert after “base” the phrase: “without hind angles, broadly rounded, sides deplanate.”

Page 365, lines 3, 6, and 12: substitute “scutellar” for “sutural.”

On the plate (XVI) figures 10 and 11 are transposed, so that corrections should be made accordingly on page 368 under *Ptomascopus aveyronensis* and *Palaeosilpha fraasii* and on page 370 in the Explanation of Plate XVI.

ERRATA

VOLUME XL

Page 208, 14th line from bottom: for abdiminal, read abdominal.

Page 226, 21st line from bottom: for (4), read (1).

Page 233, at bottom of page add “hyaline, a black spot behind clavus; 5 mm. *nigropicta*”

* Portevin, Encycl. Ent. VI, 1926, p. 250, and Hatch, Col. Cat. 95, 1928, p. 126, have incorrectly indicated Illiger's spelling of this name.

The New York Entomological Society

Organized June 29, 1892—Incorporated June 7, 1893

The meetings of the Society are held on the first and third Tuesday of each month (except June, July, August and September) at 8 P. M., in the AMERICAN MUSEUM OF NATURAL HISTORY, 77th Street and Columbus Avenue.

Annual dues for Active Members, \$3.00; including subscription to the Journal, \$4.50.

Members of the Society will please remit their annual dues, payable in January, to the treasurer.

Officers for the Year 1932

President, ANDREW J. MUTCHLER.....American Museum of Natural History, N. Y.

Vice-President, ERNEST L. BELL150-17 Roosevelt Ave., Flushing, Long Island

Secretary, ELIZABETH SHERMAN132 Primrose Ave., Mt. Vernon, N. Y.

Treasurer, GAYLORD C. HALL144 E. 22nd St., New York

Librarian, FRANK E. WATSON.....American Museum of Natural History, New York

Curator, A. J. MUTCHLER.....American Museum of Natural History, New York

EXECUTIVE COMMITTEE

WM. T. DAVIS

DR. WM. MOORE

HERBERT F. SCHWARZ,

HOWARD NOTMAN,

HENRY BIRD.

PUBLICATION COMMITTEE

HARRY B. WEISS,

CHARLES W. LENG

JOHN D. SHERMAN, JR.,

C. E. OLSEN.

PROGRAM COMMITTEE

C. H. CURRAN

HARRY B. WEISS,

J. L. HORSFALL

AUDITING COMMITTEE

E. L. BELL,

DR. E. K. SCHWARZ,

DR. E. R. P. JANVRIN.

FIELD COMMITTEE

A. S. NICOLAY,

MRS. A. S. NICOLAY

DELEGATE TO THE N. Y. ACADEMY OF SCIENCES

WILLIAM T. DAVIS

JOURNAL

of the

NEW YORK ENTOMOLOGICAL SOCIETY

Published quarterly by the Society at Lime and Green Sts., Lancaster, Pa. All communications relating to the Journal should be sent to the Publication Committee, New York Entomological Society, American Museum of Natural History, New York City; all subscriptions to Lime and Green Sts., Lancaster, Pa., or to the Treasurer, Gaylord C. Hall, 144 E. 22nd St., New York City, and all books and pamphlets to the Librarian, Frank E. Watson, American Museum of Natural History, New York City. Terms for subscription, \$3.00 per year, strictly in advance. *Please make all checks, money-orders, or drafts payable to New York Entomological Society.*

Twenty-five reprints without covers are furnished free to authors. Additional copies may be purchased at the following rates:

	4 pp.	8 pp.	12 pp.	16 pp.	24 pp.	32 pp.
25 copies	\$2.40	\$5.22	\$5.58	\$5.58	\$9.00	\$9.60
Additional 100's .....	.60	1.44	1.92	1.92	3.00	3.00
Covers	50 copies, \$2.50; additional 100's, \$1.50.					
Half-tone prints 1½ cents for each half-tone print.						

Authors whose papers are illustrated with text figures or full page plates will be required to supply the electrotypes or pay the cost of making the same by the Journal and also to pay the cost of printing full page plates on coated paper, when advisable.

VOL. XL

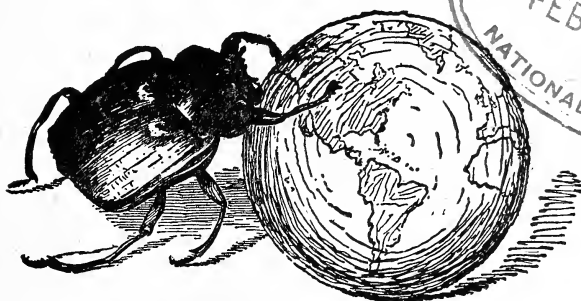
DECEMBER, 1932

publ.
9 Feb. 1933

No. 4

JOURNAL
OF THE
NEW YORK
ENTOMOLOGICAL SOCIETY

Devoted to Entomology in General



DECEMBER, 1932

Edited by HARRY B. WEISS

Publication Committee

HARRY B. WEISS

CHARLES W. LENG
C. E. OLSEN

J. D. SHERMAN, JR.

Published Quarterly by the Society

LIME AND GREEN STS.
LANCASTER, PA.
NEW YORK, N. Y.

1932

Entered as second class matter July 7, 1925, at the post office at Lancaster, Pa., under the Act of August 24, 1912.

Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized March 27, 1924.

Subscription \$3.00 per Year.

CONTENTS

Studies in American Spiders: The Genus <i>Grammonota</i> . BY SHERMAN C. BISHOP AND C. R. CROSBY	393
The <i>Rubidella</i> Group of <i>Aristotelia</i> (Lepidoptera, Gele- chidae). BY WM. T. M. FORBES	423
New and Little-Known Colorado Diptera. BY MAURICE T. JAMES	435
Doctor Ottolengui's Collection of Phytometrinae	438
New Genera and Species of Old World Oestromuscoid Flies. BY CHARLES H. T. TOWNSEND	439
Studies on Chemical Changes during the Life Cycle of the Tent Caterpillar (<i>Malacosoma americana</i> Fab.). BY WILLEM RUDOLFS	481
Cocoon Parasites of the Oriental Fruit Moth. BY BYRLEY F. DRIGGERS	489
Life History Notes and a Study of the Effects of Humidity on Adult Emergence of <i>Rhagoletis suavis</i> Cress., from Pupae at a Constant Temperature (Diptera; Trypet- idae). BY D. ELDEN BECK	497
Biology of the <i>Bidens</i> Borer, <i>Epiblema Otiosana</i> (Clem- ens) (Lepidoptera, Olethreutidae). BY GEORGE C. DECKER	503
<i>Eurymus eurytheme</i> in Maine. BY A. E. BROWER	510
The Entomology of the "Orbis Pictus" of John Amos Comenius, together with Notes on Several Early, American, Entomological Juveniles. BY HARRY B. WEISS	511
Bees Collected by Charles Darwin on the Voyage of the "Beagle." BY T. D. A. COCKERELL	519
Notes on the Life History of <i>Morpho peleides insularis</i> Fruhstorfer. BY C. REX STOLLMEYER	523
Notice	528
New Species of <i>Serica</i> (Scarabaeidae), VI. BY R. W. DAWSON	529
Book Notice	502, 563
NOTICE: VOLUME XL, NUMBER 3, OF THE JOURNAL OF THE NEW YORK ENTOMOLOGICAL SOCIETY WAS PUBLISHED ON OCTOBER 31, 1932.	

JOURNAL

OF THE

New York Entomological Society

VOL. XL

DECEMBER, 1932

No. 4

STUDIES IN AMERICAN SPIDERS: THE GENUS GRAMMONOTA

BY SHERMAN C. BISHOP AND C. R. CROSBY

GRAMMONOTA Emerton

Conn. Acad. Trans. 6: 38, 1882

Type: *Erigone pictilis* Cambr. (designated by Simon, Hist. Nat. Ar. 1: 666, 1894).

Itys Cambridge Biol. Centr. Amer. 1: 127, 1894. Type *Itys pergrata* Cambr.

In this genus we place a series of species which group themselves around *pictilis* as type. The embolic division of the male palpus is provided with a tailpiece as in *Ceraticelus*, *Caratinopsis*, etc. The embolus does not have a break as in *Ceraticelus* nor is it coiled as in *Ceratinopsis* but is looped across the end of the bulb. Unfortunately in the type, *pictilis*, the embolus is more highly specialized than in other members of the genus, the duct of the embolus being continued beyond the tip and coiled in a small, tight spiral. In this genus the colors are mostly gray and the abdomen usually bears conspicuous light markings recalling those in *Dietya*. In some species the head of the male is like that of the female (*inornata*) but in others it bears a hump (*pictilis*) or a series of lobes (*gigas*).

SPECIES DESCRIBED AS GRAMMONOTA BUT WHICH BELONG ELSEWHERE.

Grammonota venusta Banks (Phila. Acad. Nat. Sci. Proc. 1892, p. 34, pl. 5, fig. 6) equals *Eperigone tridentata* Em.

Grammonota orites Chamberlin (Ent. Soc. Am. Ann. 12: 249, pl. 17, fig. 7, 8. 1919) equals *Oedothorax montanus* Em.

Grammonota simplex Chamberlin (Same, p. 250, pl. 18, fig. 1, 2. 1919) is apparently an *Oedothorax*.

Grammonota obesior Chamberlin (Same, p. 250, pl. 17, fig. 6. 1919) was described from the female only. It is related to *Miconeta*.

Grammonota fratrella Chamberlin (Same, p. 250, pl. 18, fig. 3, 1919) was described from the female only. It is related to *Miconeta*.

Grammonota letourneuxi Simon Ar. France 5: 599, 1884. From upper Egypt. Now the type of the genus *Synaphris* Simon.

***Grammonota bidentata* Emerton**

Grammonota bidentata Emerton. Can. Ent. 58: 117, fig. 6, 1926.

We have had no specimens of this species for study. It seems to be closely related to *maculata* if not identical with it.

Type localities: Holliston and Sharon, Mass.

***Grammonota capitata* Emerton**

(Figure 37)

Grammonota capitata Emerton. Psyche, 31: 141, fig. 3, 1924.

This species is closely related to *pictilis* from which it differs, according to Emerton, in being one-eighth smaller in size. In the male the cephalothorax is slightly shorter and the hump on the head rises more abruptly behind. The male palpi and the epigynum cannot be distinguished from those of *pictilis*.

Emerton records the species from Amston, Conn., Chatham and Holliston, Mass.

***Gramonota electa* new species**

(Figures 1 and 2)

Male. Length, 2 mm. Cephalothorax dull yellow, strongly suffused with dusky except near the margin; viewed from above, evenly rounded on the sides with a slight constriction at the cervical groove, then gradually converging to the front, eyes in profile; viewed from the side, gently and evenly rounded over the back to the posterior eyes, median ocular area slanting downward in a nearly straight line. Clypeus slightly convex and

somewhat retreating. Back of the eyes there is a group of long, stiff hairs directed forward; the median ocular area clothed with a thick brush of recurved hairs. Sternum and labium pale yellow lightly suffused with dusky. Endites orange yellow. Legs light orange yellow. Abdomen has the ground color pale yellowish white and is marked with a median gray herring-bone stripe, posteriorly connected with the gray of the sides by four transverse bars in front with a gray basal band. Venter pale yellowish white.

Posterior eyes in a very slightly procurved line, equal, the median separated by three times the radius and from the lateral by a little less. Anterior eyes in a straight line, the median smaller than the lateral, subcontiguous and separated by a little more than the diameter.

Femur of palpus rather long, slender, slightly curved inward. Patella short and straight. Ratio of length of femur to that of patella as 19 to 7. Tibia oboeonic with the sides straight, the dorsal margin smooth and nearly straight; the dorso-lateral apophysis a bluntly pointed, broad, triangular tooth finely dentate on the anterior margin. Paracymbium slender, bent at a right angle and then strongly curved, the tip strongly hooked. The basal part clothed in front with a row of long hairs. The embolic division very similar to that of *inornata* except that the tip of the embolus is coiled in an open spiral of one full turn.

Female. Length, 2 mm. Similar to the male in form and color except that eyes are closer together and the gray on the abdomen covers less of the surface. The basal gray band is reduced to an irregular spot on each side and there are only two gray cross bars posteriorly. The sternum is margined with dark gray. Posterior eyes in a nearly straight line, the median slightly smaller than the lateral, separated by a little less than the diameter and a little nearer to the lateral. Anterior eyes in a straight line, the median smaller than the lateral, subcontiguous and separated from the lateral by a little less than the diameter. The epigynum consists of a strongly convex plate. The median fovea has the lateral walls curved and converging towards the front where there are two triangular openings lying close together.

Holotype male, allotype female. Turrialba, Costa Rica, 2500 ft. A. T. Aug. 12, 1929 (William Hamilton).

Grammonota gigas Banks

(Figures 3-8)

Erigonoplus gigas Banks. Can. Ent. 28: 65, 1896.

Caracladus gigas Crosby. Phila. Acad. Nat. Sci. Proc. 1905, p. 306.

Grammonota gigas Emerton. Conn. Acad. Sci. Trans. 14: 187, pl. 2, fig. 8, 1909.

Male. Length, 2.4 mm. Cephalothorax orange strongly suffused with dusky, head darker except the cephalic lobes; viewed from above rounded on the sides and convergent towards the front with only a slight constriction at the cervical groove, front rather narrow, rounded; viewed from the side, rather steeply ascending behind and then gently rounded over to the base of the cephalic lobe, median ocular area slightly convex, clothed with a group of erect recurved hairs. Clypeus strongly convex and slightly retreating. Cephalic lobe consists of 5 thick parallel finger-like rounded ridges, the median extending forward between the posterior median eyes. Sternum and labium orange strongly suffused with dusky, darker at the margin. Endites orange, lighter distally. Legs light yellowish-orange; the metatarsi of the first legs strongly enlarged, fusiform, distinctly paler. Abdomen gray, anteriorly above there is a large area in which the integument is strongly indurated, smooth and shining, dusky orange. Posteriorly the abdomen is pale marked with 3 or 4 transverse gray bars connected with a median stripe. Venter somewhat lighter.

Posterior eyes in a slightly procurved line, equal and equidistant separated by 3 times the radius. Anterior eyes in a recurved line, the median smaller than the lateral, separated by the radius and from the lateral by twice the diameter.

Femur of palpus rather stout, cylindrical, slightly curved inward. Patella short and thick. Ratio of length of femur to that of patella as 21 to 7. Tibia obconic, viewed from above the mesal side somewhat convex, the dorsal margin smooth, gently and broadly excavated toward the base of the dorso-lateral apophysis. The latter is black, broadly triangular, and minutely dentate on the mesal margin. The paracymbium long, slender, strongly curved and slightly enlarged at tip.

Embolus division of the same type as in *inornata*, the terminal loop is long enough to be visible from the back of the palpus.

Female. Length, 2.5 mm. Similar to the male in form and color. The epigynum consists of a convex plate. The median fovea is bounded laterally by nearly straight walls, broadly rounded in front. The middle lobe straight behind and overhung by a broadly rounded lobe in front.

Type locality: Ithaca, N. Y.

New York: Lake Tear of the Clouds, Mt. Marcy, July 11, 1918, 1 ♂ 1 ♀; West Kilns, Clinton Co., June 28, 1931, 1 ♂ 2 ♀; Trenton Falls, June 5, 1921, 1 ♀; Parkers, Lewis Co., Sept. 2, 1926, 2 ♀, (Chapman); Cinnamon Lake, Schuyler Co., July 20, 1930, 1 ♂; July 4, 1924, 2 ♂; Labrador Pond, June 25, 1922, 1 ♀; Freeville, April 27, 1921, 1 ♂; May, 1911, 1 ♂; McLean, June 21, 1924, 1 ♀; Howard, July 5, 1924, 2 ♀; Ithaca, May, 1 ♀.

Iowa: Clay, July 20, 1907, 1 ♂ from stomach of *Bufo americanus* (U. S. Biological Survey).

Emerton also records it from Fitzwilliam, N. H., and Plum Island, Mass.

Grammonota inornata Emerton

(Figures 9-13)

Grammonota inornata Emerton. Conn. Acad. Sci. Trans. 6: 39, pl. 10, fig. 5, 1882.

Male. Length, 1.9 mm. Cephalothorax dark brown almost black, a little lighter posteriorly; viewed from above evenly rounded on the sides, slightly constricted at the cervical groove, broadly rounded across the front; viewed from the side, evenly and gently rounded over the back to the top of the head which is higher than the posterior eyes. Head nearly normal; clypeus nearly straight and very slightly retreating.

Posterior eyes in a straight line, equal, the median separated by the diameter and a little farther from the lateral. Anterior eyes in a straight line, the median smaller than the lateral, separated by the radius and from the lateral by the diameter.

Sternum dark brown, blackish at the margin, finely rugulose. Labium and endites dark brown, lighter distally. Legs orange yellow. Abdomen dark gray without any distinct pattern of lighter markings, a little pointed in front and longitudinally wrinkled.

Femur of palpus cylindrical, moderately slender and gently curved inward; patella short and broad. Ratio of length of femur to that of patella as 15 to 6. Tibia viewed from the side obconic, obliquely truncate distally with a short, sharp, incurved tooth on the dorso-lateral angle; viewed from above the margin is smooth and straight except for this same tooth. Paracymbium

broad at base, the narrower terminal part arising at a right angle from the basal part; tip slightly hooked; the basal part with a row of 4 stiff hairs. Bezel broad and rounded, the edge smooth. Tail-piece of the embolic division very long and spirally curved, the tip lying in the angle between the tibia and the base of the cymbium. The embolus black, rather stout when it emerges from behind the bezel but gradually narrows to a fine point without any break, not coiled but looped across the end of the bulb.

Female. Length, 2.3 mm. Similar to male in form and color, but the head is a little wider and the posterior eyes are in a slightly recurved line. The epigynum is a strongly convex plate; the middle lobe is short and broad.

Type localities: Saugus and Woods Hole, Mass., New Haven, Conn.

Massachusetts: Woods Hole, Aug. 20, 1925, 22 ♂ 41 ♀, under weeds on beach (W. T. M. Forbes); July 10, 1919, 1 ♂ 6 ♀ (Forbes); Sept. 20, 1922, 11 ♂ 2 ♀ (Forbes).

New York: Cutchogue, Sound Beach, Aug. 28, 1920, 1 ♂; Orient Point, Aug. 28, 1920, 1 ♂ 2 ♀; Tottenville, Nov. 17, 1918, 1 ♂ 3 ♀; Sea Cliff, June 13, 1919, 1 ♂, 1 ♀; Mattituck, Aug. 28, 1920, 2 ♂; Riverhead, Sept. 10, 1922, 1 ♂; Cold Spring Harbor, July 13, 1930, 2 ♂.

Missouri: Columbia, July 1905, 2 ♂ 2 ♀; Nov. 1904, 40 ♂ 79 ♀; Jan. 1905, 1 ♀; Oct., 8 ♂ 4 ♀; June, 4 ♂ 1 ♀; Pierce City, Mar., 1 ♂, 4 ♀.

Emerton also records the species from Anticosti Id., Dauphin, Man., Lyme, Conn., Providence and Newport, R. I., Hyannis, Chatham, Provincetown, Boston and Ipswich, Mass.

Grammonota insana Banks

(Figures 14-17)

Acartauchenius insanus Banks, Cal. Acad. Sci. Proc. Ser. 3, 1: 242, Pl. 14, fig. 12, 1898.

Male. Length, 2.5 mm. Cephalothorax brownish, lighter on the head. Viewed from above evenly rounded on the sides, narrowed from the cervical groove; viewed from the side, evenly rounded over the back, highest back of the eyes. From this point it slopes to the anterior median eyes. Just back of the

eyes there is a cluster of stiff hairs slanting forward and similar hairs directed upward occupy the ocular area. Clypeus retreating. Sternum and labium brownish, darker toward the edge. Endites light, like the legs. Legs and palpi dusky yellow.

Posterior eyes in a strongly procurved line, anterior eyes gently recurved.

Abdomen straw yellow, nearly white, gray on the sides except in front and marked down the middle with a gray stripe broken into spots posteriorly, the spots connected with the gray on the sides by narrow transverse bands. Venter light, marked with gray toward the spinnerets and along the sides.

Tibia of male palpus armed with a short, stout, dorso-lateral apophysis.

Female. Length 3 mm. Similar to the male in coloration. The pattern on the back of the abdomen is more distinct but does not reach the tip, which is yellowish. The head is not so highly elevated as in the male and the clusters of stiff hairs are absent.

Posterior eyes in a strongly procurved line; anterior eyes gently recurved. Anterior tibiae armed beneath with two rows of seven or eight stiff hairs. The epigynum is a gently convex plate, the middle lobe broad with the lateral walls short and convergent.

Redescribed from one male and two female types, San Miguel Heracosta, Sonora, Mexico.

***Grammonota inusiata*, new species**

(Figures 18 and 19)

Male. Length, 1.9 mm. Cephalothorax chestnut brown; viewed from above, evenly rounded on the sides, very slightly constricted at the cervical groove and then slightly narrowed towards the front, eyes in profile; viewed from the side, moderately ascending behind to the cervical groove, then in an almost straight line to the back of the head and then rounded over the head to the posterior median eyes. Clypeus almost straight and slightly retreating. Sternum and labium dusky orange, darker at the margin. Endites dusky orange, lighter distally. Legs orange. Abdomen gray with a herring-bone pattern on the posterior half and a dark median line anteriorly.

Posterior eyes in a straight line, equal, the median separated by the diameter and a little farther from the lateral. Anterior eyes in a very slightly recurved line, the median smaller than the lateral, subcontiguous and separated from the lateral by the diameter.

Femur of palpus short and stout, nearly straight. Patella short. Ratio of length of femur to that of patella as 16 to 7. Tibia obconic, evenly convex. The sides nearly straight, the dorsal margin smooth and evenly convex. The dorso-lateral apophysis rather blunt, incurved, the mesal margin minutely dentate. The embolic division much as in *inornata*, the embolus long, not coiled, merely looped across the end of the bulb.

Female. Length, 2.5 mm. Similar to the male in form and markings. Epigynum with the median lobe rectangular with the sides slightly rounded, over-hung in front by a rounded triangular lobe.

Holotype, male; allotype, female. Barneveld, N. Y., Sept. 7, 1919. G. N. Wolcott.

New York: Barneveld, Aug. 24, 2 ♂ 2 ♀; Sept. 13, 1 ♂; June 3, 1 ♀; Aug. 18, 2 ♀; July 26, 2 ♀; Aug. 20, 1 ♂, 1 ♀; Aug. 4, 3 ♀. All collected by G. N. Wolcott in 1919. Ithaca, May, 1 ♂.

Grammonota kincaidi Banks

(Figures 22 and 23)

Gonglydium kincaidi Banks. Proc. Ent. Soc. Wash. 7: 96, pl. 2, fig. 1, 1905.

Oedothorax kincaidi. Petrunkevitch. Catalogue p. 262, 1911.

Male. Length, 1.9 mm. Cephalothorax dusky orange yellow, with darker radiating lines, narrowly margined with darker; viewed from above, evenly and broadly rounded on the sides to the cervical groove where there is a slight constriction, evenly and broadly rounded across the front; viewed from the side gently ascending behind to the cervical groove then continuing in an almost straight line to the top of the head where it rounds over gently to the posterior eyes. Along the median line, in front of the cervical groove, there is a row of 5 or 6 long stiff hairs directed forward. Clypeus almost straight and slanting slightly forward. Sternum dusky orange yellow with faint, radiating, darker markings. Labium and endites orange yellow, lighter distally. Legs dusky orange. Abdomen pale with the sides and a central herring-bone pattern dark gray.

Posterior eyes in a straight line, equal, the median separated by the diameter and a little farther from the lateral. Anterior eyes in a straight line, the median smaller than the lateral, separated by less than the radius and from the lateral by a little less than the diameter.

Femur of palpus rather short, cylindrical, slightly widened distally, gently curved inward. Patella short and stout. Ratio of length of femur to that of patella as 13 to 4. Tibia obconic, the dorsal margin smooth and nearly straight curving forward to form the mesal margin of the dorso-lateral apophysis. The latter is short, incurved, and the inner margin of the tip is finely dentate. The embolic division is very similar to that of *inornata*.

Type locality: Olympia, Wash.

Washington: Friday Harbor, June-July, 1928, 1 ♂ (Shackelford).

Grammonota maculata Banks

(Figures 24-26)

Grammonota maculata Banks. Trans. Am. Ent. Soc. 23: 68, 1896.

Male. Length, 2 mm. Cephalothorax dusky yellowish; viewed from above, rather broad, evenly rounded on the sides to the cervical groove where it is very slightly constricted, eyes in profile; viewed from the side ascending behind to the cervical groove where there is a shallow depression, then evenly rounded over the head to the eyes. Clypeus slightly convex and retreating. Sternum light yellow, dusky at margin. Labium and endites brighter yellow. Legs pale yellow. Abdomen dirty white with a median longitudinal gray stripe, widened at the segments and obsolete posteriorly. Sides of abdomen marked with two or three large, irregular, gray spots darker around the spinnerets. Venter pale. Posterior eyes in a straight line, the median slightly larger than the lateral, separated by the diameter and from the lateral by a little less. Anterior eyes in a slightly recurved line, the median smaller than the lateral, subcontiguous, separated from the lateral by a little more than the radius.

Femur of palpus rather short and stout, slightly widened distally and gently curved inward. Patella broad. Ratio of length of femur to that of patella as 15 to 7. Tibia short, obconic but the sides are not so straight as in *inornata*, broadly and evenly emarginate mesally from the dorso-lateral apophysis, which terminates in two rounded teeth. Paracymbium strongly curved,

slightly enlarged at the tip. The embolic division very similar to that of *inornata*, the embolus not coiled but looped across the end of the bulb.

Female. Length, 2.2 mm. Cephalothorax darker than in the male. Abdomen light above with a median longitudinal dark stripe, which posteriorly is widened along the segments to form narrow transverse bands, uniting with the spots on the sides. Venter light. The epigynum consists of a quadrate plate with rounded corners marked in front by a transverse lunate plate darker and more heavily chitinized. The middle lobe is transverse, rectangular, in front of which the interior parts show through as indicated in the figure.

Type localities: Runnymede, Fla., and Brazos Co., Texas.

Texas: Houston, Dec. 9, 1928, 1 ♂ 1 ♀ (P. D. Harwood).

Mississippi: Lucedale, May, 1929, 1 ♂ (H. Dietrich).

New York: Shinnecock Hills, L. I., June 15, 1919, 1 ♀.

Virginia: East Falls Church, June 30, 1926, 1 ♀.

Florida: Wewahitchka, Dead Lake, April 6, 1927, 1 ♀.

Georgia: Billy's Island, Okefinokee Swamp, June, 1912, 2 ♂.

Costa Rica: Turrialba, Aug. 10, 1927, 1 ♀ (Hamilton).

Rosenfeld also records the species from Mansura, La., in Spanish moss.

Grammonota maritima Emerton

(Figures 20 and 21)

Grammonota maritima Emerton. Can. Ent. 57: 67, fig. 4, 1925.

Male. Length, 2.8 mm. Cephalothorax orange, head somewhat suffused with dusky; viewed from above, evenly rounded on the sides, very slightly constricted at the cervical groove, eyes in profile, the head broad. Cephalothorax viewed from the side rather steeply ascending behind to the cervical groove and then gently rounded over the head to the posterior eyes. Head back of the eyes sparsely clothed with black hairs directed forward, shorter hairs along the radiating furrows. Clypeus almost straight and slightly protruding. Sternum and labium orange, slightly suffused with dusky and darker at the margin. Endites lighter. Legs and palpus yellowish orange. Abdomen gray with a median light herring-bone pattern.

Posterior eyes in a straight line, equal, the median separated by 3 times the radius and from the lateral by the diameter. Anterior eyes in a straight line, the medium smaller than the lateral, separated by the radius and from the lateral by a little more than the diameter.

Femur of palpus moderately long and slender, slightly curved inward. Patella short and thick. Ratio of length of femur to that of patella as 18 to 8. Tibia short, obconic. The dorso-lateral process incurved, black, moderately short and blunt, minutely dentate on the mesal margin. This process is bounded laterally by a distinct rounded notch and mesally the margin is nearly straight with a small, irregular tooth near the center. The mesal margin of the tibia thin and smoothly rounded. Lateral margin somewhat expanded, evenly rounded, armed with a row of 4 stiff hairs just back of the margin. Paracymbium broad at base, gradually narrowed and strongly curved. Tail-piece of the embolic division long and slender and extending over the edge of the cymbium. The terminal part long, slender, coiled in a loose spiral of one turn with an extra reverse loop at the tip.

Female. Length, 2.9 mm. Similar to male in form and color. Head back of eyes not dusky. The epigynum consists of a quadrate plate with rounded edges. The median fovea rectangular with the sides nearly parallel, the middle lobe over-hung from in front by a broadly rounded lobe. The fovea bounded in front by a nearly straight, continuous transverse ridge; in *gigas* this ridge is interrupted in the middle.

Described from 1 ♂ 1 ♀ from Barrington, N. S., Sept. 8, 1923, collected in moist gravel under litter washed up by the tide by Miss Elizabeth B. Bryant who kindly presented us with these specimens from the type lot.

Grammonota ornata Cambridge

(Figures 27-29)

Erigone ornata Cambridge. Zool. Soc. London Proc. 1875, p. 395, pl. 46, fig. 3.

Grammonota ornata Emerton. Conn. Acad. Sci. Trans. 6: 36, pl. 10, fig. 3, 1882.

Male. Length, 2 mm. Cephalothorax light chestnut brown; viewed from above evenly rounded on the sides with scarcely any indication of a constriction at the cervical groove; viewed from the side gradually ascending behind without any depression at the cervical groove, rounded over the head to the posterior eyes. Clypeus almost straight and somewhat retreating. Area back of the posterior eyes sparsely clothed with moderately long erect hairs. Median ocular area clothed with short, pale hairs directed upward. Sternum and labium dusky orange, darker at the margin. Endites orange, lighter distally. Legs yellowish orange. Abdomen dark gray with two pairs of irregular light spots on the front half and four or five transverse light bars on posterior half, the anterior bars often interrupted.

Posterior eyes in a straight line, equal, the median separated by slightly more than the diameter and a little farther from the lateral. Anterior eyes in a very slightly procurved line, the median smaller than the lateral, separated by less than the radius and from the lateral by the diameter.

Femur of palpus rather short and stout, slightly curved inward. Patella short and straight. Ratio of length of femur to that of patella as 15 to 6. Tibia obconic, much like *maculata* but the dorsal margin has the excavation mesad of the dorso-lateral apophysis shallower. The dorso-lateral apophysis is short, armed with two black teeth, the mesal one shorter and acute, the lateral one blunt at tip. Paracymbium long and very strongly curved, slightly enlarged at tip. The embolic division, as in *inornata*, the embolus not coiled but looped across the tip of the bulb.

Female. Length, 2.5 mm. Similar to male in form and color but the abdominal markings are more distinct. The epigynum consists of a plate notched in the middle in front; the middle lobe is a quadrate plate over-hung from in front by a bluntly pointed lobe and crossed by a deeply impressed line parallel with the margin of the overhanging anterior lobe.

Type locality: Providence, Mass., (*sic*), probably R. I.

Allotype, female, Staten Island, N. Y.

New York: Clove Valley, Staten Island, Nov. 16, 1918, 2 ♂ 1 ♀; Montauk Pt., May 24, 1924, 1 ♀.

New Jersey: Mays Landing, June 1925, 2 ♂ (Fletcher).

Emerton also records the species from Reading and Tyngsboro, Mass. Banks records it from Black Mts., N. C.

Grammonota pallipes Banks

(Figures 30-32)

Grammonota pallipes Banks. N. Y. Ent. Soc. Jour. 3: 86, 1895.

Male. Length, 2.3 mm. Cephalothorax brownish yellow, darker on the head. Seen from the side evenly rounded to the cervical groove. Head not elevated. Clypeus nearly perpendicular, only slightly projecting. Chelicerae dark brown. Sternum and labium brownish, darker towards edge. Endites light brownish yellow. Posterior row of eyes gently procurved, anterior row slightly recurved. Abdomen light yellowish with a distinct herring-bone pattern. Venter and sides of abdomen more or less suffused with grayish. Legs and palpi brownish yellow.

Tibia of palpus provided with a triangular dorso-lateral process; on the mesal side at base there is a minutely dentate rounded lobe mesad of which there is a rounded emargination. The embolic division is of the *inornata* type.

Female. Length, 2.5 mm. Cephalothorax yellowish brown. Sternum and labium dusky orange. Endites yellowish orange, lighter distally. Legs orange. Abdomen pale dirty yellowish with a darker median stripe in front which posteriorly becomes herring-bone-shaped.

The epigynum a roughly quadrate plate. The anterior margin has a sharp notch in the middle which extends into a black-topped, nipple-like projection. The middle lobe transverse, the sides rounded and convergent forward. Anteriorly it is overlain by a rounded, pale-colored lobe which is slightly notched behind and marked with a fine, median dark line.

Male described from the type in the Museum of Comparative Zoology, female from 15 specimens found in a vial containing the types of *Grammonota trivittata* Banks, from Roslyn, N. Y.

Type locality: Long Island, N. Y., probably near Sea Cliff.

New Jersey: May's Landing, June, 1925, 1 ♀ (Fletcher).

Grammonota pictilis Cambridge

(Figures 33-36 and 38-39)

Erigone pictilis Cambridge. Zool. Soc. Lond. Proc. 1875, p. 396, pl. 46, fig. 4.

Grammonota pictilis Emerton. Conn. Acad. Sci. Trans. 6: 38, pl. 10, fig. 4, 1882.

Erigone pictilis Keyserling. Spinnen Am., Therid. 2: 194, pl. 18, fig. 252, 1886.

Grammonota pictilis Crosby. Phil. Acad. Nat. Sci. Proc. 1905, p. 310.

Male. Length, 2.5 mm. Cephalothorax yellowish brown with the head lighter; viewed from above broadly rounded on the sides, the margin crenulate, very slightly constricted at the cervical groove and broadly rounded across the front; viewed from the side, evenly and gently rounded over the back to the cervical groove, then elevated into a cone-shaped hump behind the eyes; median ocular area convex, clypeus almost straight and slightly protruding. Median ocular area clothed with recurved hairs longest in the middle; the cephalic hump clothed with stiff erect hairs, those in front directed forward.

Posterior eyes in a straight line, equal, equidistant and separated by a little less than twice the diameter. Anterior eyes in a very slightly recurved line, the median smaller than the lateral, separated by the diameter and from the lateral by twice the diameter.

Sternum, labium and endites yellowish brown darker at margin. Legs dusky yellowish. Abdomen black ornamented above with a pattern of light markings which anteriorly are united to form two broad longitudinal stripes and posteriorly form short transverse bars.

Femur of palpus moderately long, slender, and slightly widened distally; patella short. Ratio of length of femur to that of patella as 12 to $4\frac{1}{2}$. Tibia short without any true dorsal apophysis, the dorsal margin being nearly straight with a very small black tooth in the center. Laterally the margin is extended into a thin, curved, beak-like process which is bounded laterally by a triangular emargination. At the base of this

process there is, in the specimen from Nova Scotia, a small black tooth on the surface of the tibia. Paracymbium long, slender and evenly curved. The bezel is high, thin and slightly notched at the point of emergence of the embolus. The tail-piece of the embolic division long, slender and spirally curved, the tip reaching to the tibia. The embolus is basally a stout curved black rod which makes nearly one complete turn around the tip of the bulb where it ends in a sharp point after giving off the ejaculatory duct accompanied by a thin membranous conductor. The duct makes a semicircular loop across the end of the bulb and is then coiled in a flat spiral of four or five turns which lies in the angle between the bezel and the base of the embolus.

Female. Length, 2.6 mm. Similar to male in form and color. Posterior eyes in a straight line, equal, the median separated by the diameter and a little farther from the lateral. Anterior eyes in a slightly recurved line, the median smaller than the lateral, separated by a little less than the radius and from the lateral by the diameter. The epigynum has a large squarish opening, rounded in front in which the middle lobe is anteriorly deeply depressed below the general level of the epigynum and provided with two large distinct oval openings. The posterior margin of the middle lobe is elevated, more broadly so on the sides.

Type locality: Beverly, Swampscott and Boston, Mass.

Nova Scotia: Digby, 1 ♂.

New Hampshire: Hollis, Aug., 4 ♀ (Fox); Pike, May, 1903, 1 ♀ (Hayhurst); Randolph, Sept. 1, 1906, 1 ♀ (Nelson).

New York: Little Pond, Orange Co., May 25, 1920, 1 ♂; Ithaca, July-Aug., 1 ♀; Letchworth Park, July 9, 1922, 2 ♀; Trenton Falls, June 25, 1921, 1 ♀; Bumps Pond, Washington Co., July 28, 1920, 1 ♀; Chapel Pond, June 27, 1923, 1 ♂ (Chapman); Ithaca, Banks collection. Stamford, May 28, 1921 (H. P. Chrisp). The specimen Banks left in the Cornell collection is an immature example lacking one molt. One side is male and the other female.

South Dakota: Hill City, 2 ♀ (Marx) Fox collection.

Maine: Sebasicook Lake, Aug. 24, 1925, 1 ♀; Falmouth, Aug. 30, 1925, 1 ♀; Winterport, Aug. 29, 1925, 7 ♀; Island Falls, Aug. 27, 1925, 1 ♀.

Emerton also records this species from Southern Labrador; Truro, N. S.; Monfort, Que.; Ottawa and Minaki, Ont.; Dauphin and LePas, Manitoba.

Grammonota semipallida Emerton

Grammonota semipallida Emerton. Can. Ent. 51: 105, pl. 7, fig. 3, 1919.

We have been unable to study specimens of this species, which is recorded by Emerton from Winnipeg, Manitoba.

Grammonota spinimana Emerton

(Figures 40-42)

Grammonota spinimana Emerton. Can. Ent. 55: 240, fig. 3, 1923.

Male. Length, 2.5 mm. Cephalothorax viewed from above rather broad, evenly rounded on the sides with a very slight constriction at the cervical groove, bluntly rounded across the front; viewed from the side steeply ascending behind, then nearly level with a very gentle arch back of the eyes. A median row of stiff hairs directed forward extending from the cervical groove to between the posterior median eyes. Between these eyes there is a low ridge which is cut off square in front even with the front margin of these eyes. Clypeus slightly convex and somewhat protruding. The first and second legs are distinctly thickened and the tibiae and metatarsi are armed below with rows of stiff, stout, erect hairs.

Posterior eyes in a straight line, equal and equidistant separated by the diameter. Anterior eyes in a very slightly recurved line, the median smaller than the lateral, separated by less than the radius and from the lateral by a little more than the diameter.

Femur of palpus rather short and thick, broader distally. Patella short, as broad as femur. Tibia short and broad, the front margin smooth, gently and broadly concave mesally from the dorso-lateral apophysis. The latter black, rather slender, and not strongly incurved. The ventro-lateral angle of the tibia prolonged into a black, beak-shaped tooth. Paracymbium strongly curved, the tip only slightly enlarged. The embolic

division much as in *inornata*. The median apophysis appears as a notched process just inside the bezel and seems to serve as a support for the terminal part of the embolus.

Type locality: Moose Island, James Bay, Canada.

Montana: Billings, Biological Survey Card No. 1778, 1 ♂, Aug. 19, 1909, from stomach of *Bufo woodhousii*.

Utah: Washington Co., Biological Survey Card No. 1713, 1 ♂, from stomach of *Bufo woodhousii*.

Colorado: Pingree Park, Aug. 20, 1924, 1 ♂ (C. R. Jones); Bear Creek, Morrison, Aug., 1906, 1 ♀ (Oslar).

***Grammonota texana* Banks**

(Figures 43-47)

Acartauchenius texanus Banks. Ent. Soc. Wash. Proc. 4: 192, 1899.

Male. Length, 2.3 mm. Cephalothorax orange yellow; viewed from above evenly rounded on the sides with a slight constriction at the cervical groove, eyes in profile; viewed from the side rather steeply ascending behind to the cervical groove, then gradually ascending to base of the cephalic hump. The hump is very high and bears a cluster of long, procurved hairs on the back near the apex. Median ocular area convex and densely clothed with long recurved hairs. Clypeus slightly convex and somewhat retreating. Sternum and labium dusky yellow, darker at the margin. Endites yellowish, lighter distally. Legs yellowish tinged with orange. Abdomen yellowish-gray with a median longitudinal dark stripe which does not reach the anterior end and which posteriorly may form an interrupted, herring-bone pattern or may be obliterated. In some specimens it is reduced to a short gray stripe on the middle of the abdomen.

Posterior eyes in a slightly procurved line, equal, the median separated by twice the diameter and from the lateral by three times the radius. Anterior eyes in a recurved line, the median smaller than the lateral, separated by the radius and from the lateral by three times the radius.

Femur of palpus rather stout, cylindrical, and curved inward at base. Patella short and thick. Ratio of length of femur to that of patella as 18 to 7. Tibia short, obconic, when viewed

from above the sides straight, the dorsal margin smooth, broadly and evenly convex, the dorso-lateral apophysis broad, quadrate, thin, incurved with the edge finely dentate. This apophysis is bounded mesally by a rather deep rounded notch. The embolic division much as in *inornata*. The median apophysis appears as a thin, broad process lying at the apical end of the bezel, its outer angle black and bluntly pointed.

Female. Length, 2.8–3.8 mm. Similar to male in color but the dark markings on the abdomen are usually better developed and the sides are often marked with dark patches. Tibiæ of first and second legs armed beneath with a double row of long, slender spines. Posterior eyes in a slightly procurved line, equal and equidistant, separated by about the diameter. Anterior eyes in a slightly recurved line, the median a little smaller than the lateral, separated by less than the radius and from the lateral by three-fourths the diameter. The epigynum consists of a quadrate plate, the sides of which are rounded; on the anterior part the surface is transversely wrinkled. The lateral bounding walls of the median fovea moderately convergent towards the front and then parallel or divergent from the last third. The median lobe is over-hung from in front by a rather large heart-shaped lobe. In front of the epigynum there is a narrow transverse hardened sclerite.

Type localities: Shreveport, La.; Holly Springs, Miss.; and Brazos Co., Texas.

Georgia: Thunderbolt, June 26, 1912, 4 ♂ 8 ♀; Billy's Island, Okefinokee Swamp, June, 1912, 1 ♂ 3 ♀.

Arkansas: Hope, June–July, 6 ♂ 10 ♀, beating flowers (Knobel); Sept. 1, 1926, 1 ♀, beating underbrush (Knobel).

Louisiana: Shreveport, ♂ ♀.

Alabama: Biol. Sur. Card No. 279, *Bufo terrestris*, Mobile, 1892, 1 ♂, (J. Hurter).

Mississippi: Ocean Springs, Apr. 26, 1931, 4 ♀; June 4, 1930, 1 ♂ 4 ♀ (Dietrich); Isle of Caprice, Biloxi, June 15, 1930, 1 ♀ (Dietrich); Holly Springs ♂ ♀.

Florida: Lake Jackson, Leon Co., April 12, 1927, 1 ♀; Alachua Co., 1 ♂; Orlando, Oct. 11, 1926, 2 ♀ (Culver); Micanopy, May 9, 1926, 1 ♀ (Hubbell).

Texas: Brazos Co., ♂ ♀; no locality, 2 ♀ (Yothers); Houston, Feb. 1929, 1 ♀.

***Grammonota trivittata* Banks**

(Figures 48 and 49)

Grammonota trivittata Banks. N. Y. ENT. SOC. JOUR. 3: 86, 1895.

Grammonota trivittata Emerton. Conn. Acad. Sci. Trans. 16: 388, pl. 1, fig. 6, 1911.

Male. Length, 2 mm. Cephalothorax dull yellow strongly suffused with dusky except on the head; head dull yellowish; viewed from above, evenly rounded on the sides with a slight constriction at the cervical groove, broadly rounded across the front; viewed from the side, evenly ascending in a straight line to the cervical groove and then evenly and broadly rounded over the head to the posterior eye. Clypeus slightly convex and somewhat protruding. Sternum and labium dusky orange darker on the margin. Endites pale dull orange. Legs yellowish. Abdomen dull white with a median longitudinal dark stripe with irregular edges, posteriorly somewhat herring-bone-shaped. Sides of abdomen gray. Venter pale.

Posterior eyes in a straight line, equal, the median separated by the diameter and a little farther from the lateral. Anterior eyes in a straight line, the median smaller than the lateral, separated by less than the radius and from the lateral by the diameter.

Femur of palpus moderately stout, cylindrical, almost straight. Patella short and straight. Ratio of length of femur to that of patella as 22 to 10. Tibia obconic, the dorsal margin straight. The dorso-lateral apophysis only moderately incurved and with only a slight indication of being dentate on the median side.

Female. Length, 3 mm. Cephalothorax brown with the head pale. Marking on abdomen of the same type as in the male. Epigynum consists of a plate, nearly circular in outline, somewhat truncate behind. The median fovea with the sides nearly straight, converging toward the front, rounded in front. The middle lobe crossed in front of the middle by a strongly curved groove convex posteriorly, in front of which are the openings.

Type locality: Sea Cliff, N. Y.

Massachusetts: Wellfleet, Aug. 28, 1918, 1 ♂; Woods Hole, July, 1919, 1 ♀ (Forbes).

New York: Roslyn, Banks, types in M. C. Z.

Connecticut: Hammonasset Beach, July 26, 1923, 1 ♀.

Emerton also records this species from Lyme, Conn.; Providence and Newport, R. I.; Martha's Vineyard, Nantucket, Hyannis, Chatham, Provincetown, Plymouth, Boston, Gloucester, and Ipswich, Mass.; Bath and Thomaston, Me.

Grammonota vittata Barrows

(Figures 50-52)

Grammonota vittata Barrows. Ohio Jour. Sci. 19: 357, pl. 15, fig. 1, 1919.

Male. Length, 2 mm. Cephalothorax orange, lightly suffused with dusky; viewed from above evenly rounded on the sides with a slight constriction at the cervical groove, eyes in profile; viewed from the side, gradually ascending behind to the cervical groove and then very gently arched over the head to the posterior eyes. There is a median row of hairs directed forward in front of the cervical groove; the row is double between the posterior median eyes and there is a cluster of long curved hairs in the median ocular area. Clypeus almost straight and very slightly protruding.

Sternum and labium orange suffused with dusky, darker towards the margin. Endites yellowish orange, lighter distally. Chelicerae orange. Legs yellowish orange. Abdomen grayish yellow with a sooty, median stripe extending back two-thirds the length of the abdomen.

Posterior eyes in a straight line, equal, the median separated by a little more than the diameter and from the lateral by a little more than the radius. Anterior eyes in a very slightly recurved line, the median smaller than the lateral, subcontiguous, separated from the lateral by two-thirds the diameter.

Femur of palpus rather short, cylindrical, almost straight. Patella short and straight. Ratio of length of femur to that of patella as 18 to 8. Tibia obconic, when viewed from above the

mesal side appears convex. The dorsal margin smooth and nearly straight. The dorso-lateral apophysis very broad, quadrate, the lateral angle square. The mesal angle obtuse and finely dentate. The paracymbium long, slender, strongly curved and the tip pointed and very strongly hooked. The embolic division similar to that of *inornata* but the tail-piece is shorter. The embolus is not coiled but looped across the end of the bulb. Just back of the bezel there is a conspicuous, black, stout, curved, sharp-pointed process.

Female. Length, 2.6 mm. Similar to male in form and color. The anterior legs have the tibiae armed beneath with three pairs of long, slender spreading spines with an extra one distally; the metatarsi with two pairs. Tibia of second legs armed below with a single long spine; metatarsi armed below with two spines, not paired.

The epigynum consists of a large light-colored plate. The median fovea quadrate, the sides slightly constricted anteriorly, the front margin broadly rounded.

Type locality: Hebron, Ohio.

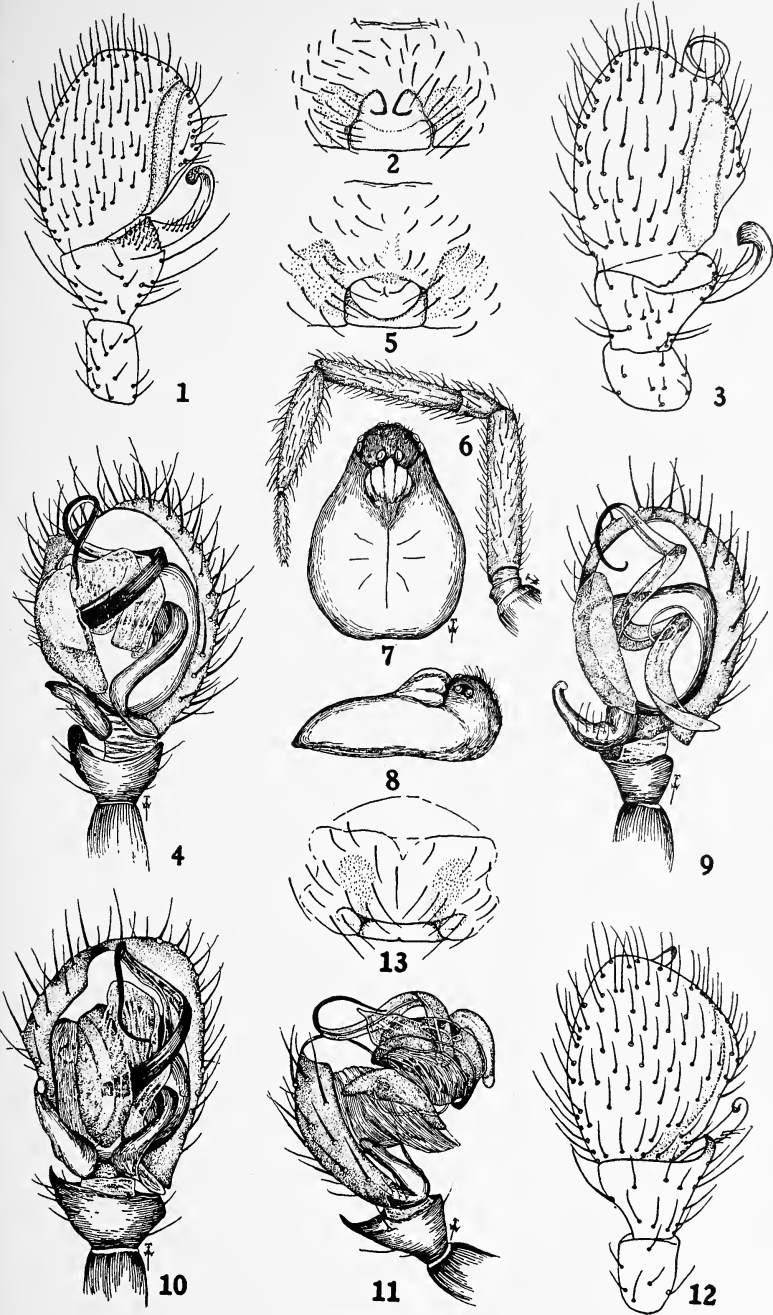
Through the kindness of Profesosr Wm. M. Barrows, of Ohio State University, we have been able to study a pair of this interesting species.

Ohio: Hebron, Oct. 3, 1918, 1 ♂ 1 ♀.

New Jersey: Mays Landing, June, 1925, 1 ♂ (Fletcher).

PLATE XVI

1. *Grammonota electa*, ♂ right palpus, dorsal view.
2. *Grammonota electa*, ♀ epigynum.
3. *Grammonota gigas*, ♂ right palpus, dorsal view.
4. *Grammonota gigas*, ♂ right palpus, ventral view.
5. *Grammonota gigas*, ♀ epigynum.
6. *Grammonota gigas*, ♂ first leg.
7. *Grammonota gigas*, ♂ cephalothorax, dorsal view.
8. *Grammonota gigas*, ♂ cephalothorax, lateral view.
9. *Grammonota inornata*, ♂ right palpus, ventral view, cleared.
10. *Grammonota inornata*, ♂ right palpus, ventral view.
11. *Grammonota inornata*, ♂ right palpus, lateral view, cleared.
12. *Grammonota inornata*, ♂ right palpus, dorsal view.
13. *Grammonota inornata*, ♀ epigynum.



GRAMMONOTA

PLATE XVII

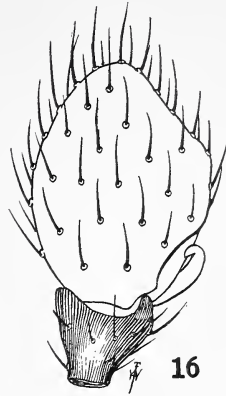
14. *Grammonota insana*, ♂ cephalothorax, dorsal view.
15. *Grammonota insana*, ♂ right palpus, ventral view.
16. *Grammonota insana*, ♂ right palpus, dorsal view.
17. *Grammonota insana*, ♀ epigynum.
18. *Grammonota inusiata*, ♂ right palpus, dorsal view.
19. *Grammonota inusiata*, ♀ epigynum.
20. *Grammonota maritima*, ♂ right palpus, dorsal view.
21. *Grammonota maritima*, ♀ epigynum.
22. *Grammonota kincaidi*, ♂ right palpus, ventral view.
23. *Grammonota kincaidi*, ♂ right palpus, dorsal view.
24. *Grammonota maculata*, ♀ epigynum.



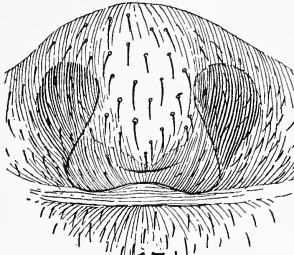
15



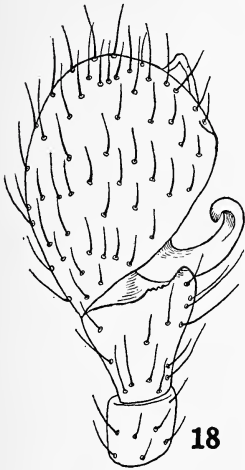
14



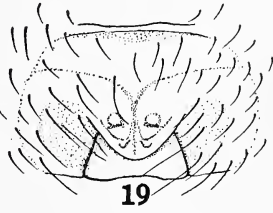
16



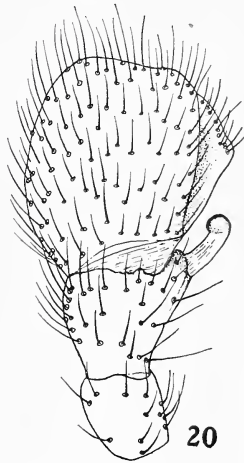
17



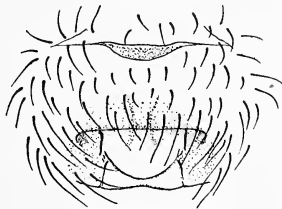
18



19



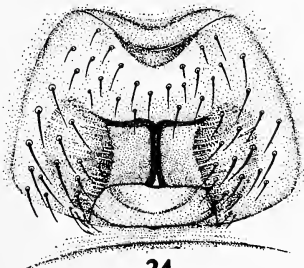
20



21

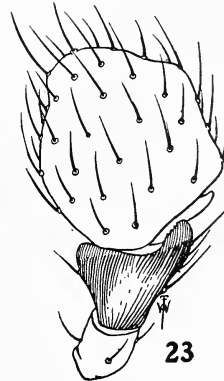


22



24

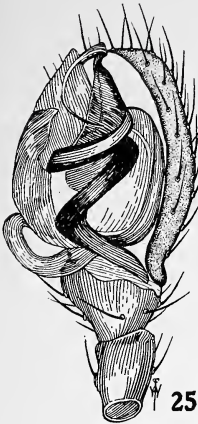
GRAMMONOTA



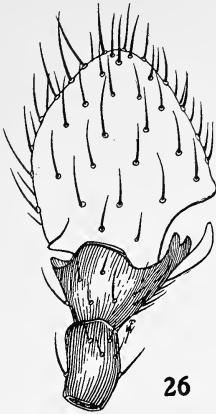
23

PLATE XVIII

25. *Grammonota maculata*, ♂ right palpus, ventral view.
26. *Grammonota maculata*, ♂ right palpus, dorsal view.
27. *Grammonota ornata*, ♂ right palpus, dorsal view.
28. *Grammonota ornata*, ♂ right palpus, ventral view.
29. *Grammonota ornata*, ♀ epigynum.
30. *Grammonota pallipes*, ♂ right palpus, ventral view.
31. *Grammonota pallipes*, ♂ right palpus, dorso-lateral view.
32. *Grammonota pallipes*, ♀ epigynum.
33. *Grammonota pictilis*, ♂ right palpus, meso-ventral view.
34. *Grammonota pictilis*, ♂ right palpus, dorso-lateral view.
35. *Grammonota pictilis*, ♂ cephalothorax, lateral view.
36. *Grammonota pictilis*, ♀ epigynum.
37. *Grammonota capitata*, ♂ head, lateral view. After Emerton.



25



26



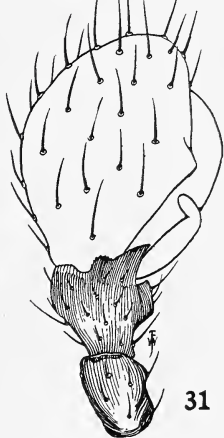
27



28



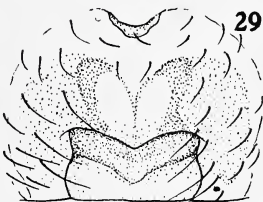
30



31



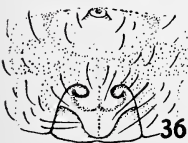
33



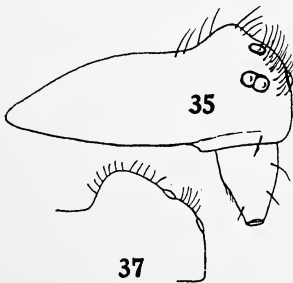
29



32



36



35

37

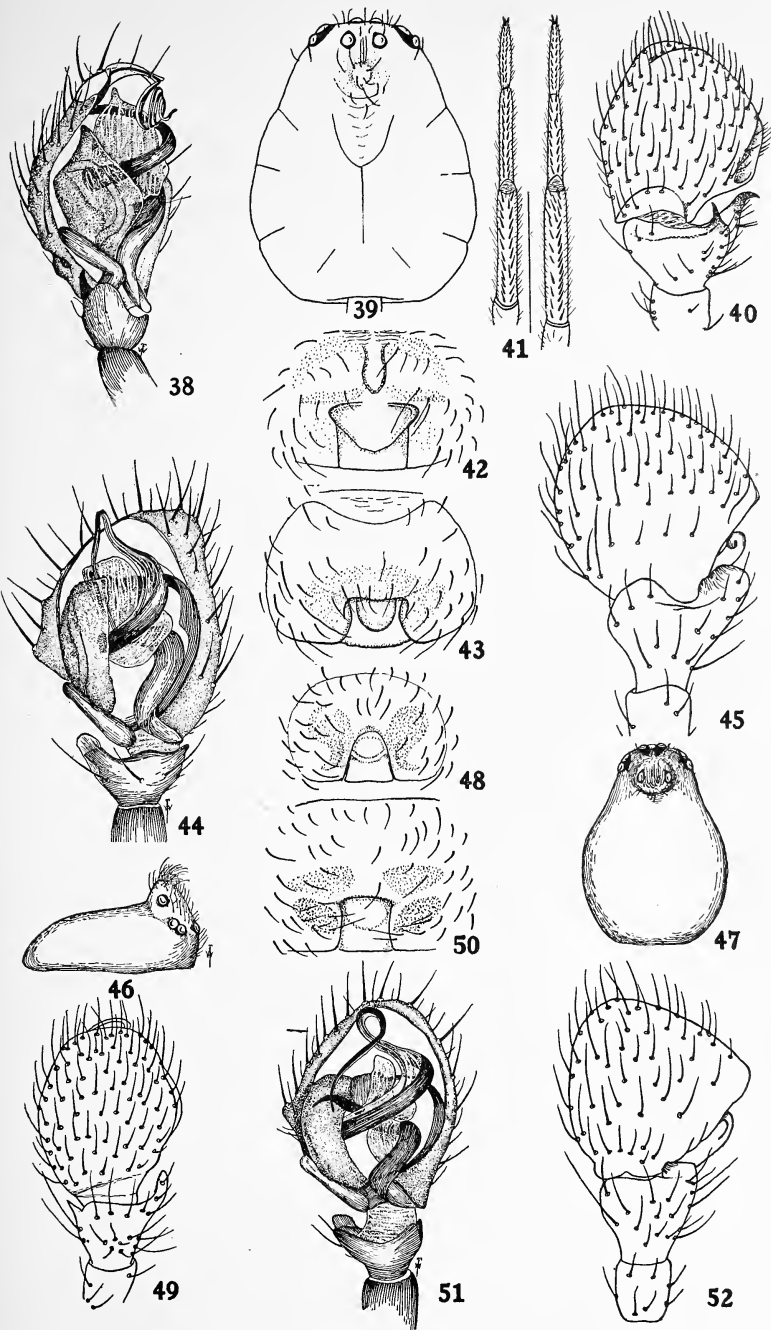


34

PLATE XIX

38. *Grammonota pictilis*, ♂ right palpus, ventro-lateral view.
39. *Grammonota pictilis*, ♂ cephalothorax, dorsal view.
40. *Grammonota spinnimana*, ♂ right palpus, dorsal view.
41. *Grammonota spinnimana*, ♂ first and second legs, ventral view.
42. *Grammonota spinnimana*, ♀ epigynum.
43. *Grammonota texana*, ♀ epigynum.
44. *Grammonota texana*, ♂ right palpus, meso-ventral view.
45. *Grammonota texana*, ♂ right palpus, dorsal view.
46. *Grammonota texana*, ♂ cephalothorax, lateral view.
47. *Grammonota texana*, ♂ cephalothorax, dorsal view.
48. *Grammonota trivittata*, ♀ epigynum.
49. *Grammonota trivittata*, ♂ right palpus, dorsal view.
50. *Grammonota vittata*, ♀ epigynum.
51. *Grammonota vittata*, ♂ right palpus, ventral view.
52. *Grammonota vittata*, ♂ right palpus, dorsal view.

The preparation of the drawings, by Albert W. Force and Helen Zorsch, was made possible by a grant from the Heckscher Research Foundation at Cornell University.



GRAMMONOTA

THE RUBIDELLA GROUP OF ARISTOTELIA (LEPIDOPTERA, GELECHIIDAE)

BY WM. T. M. FORBES

CORNELL UNIVERSITY, ITHACA, NEW YORK

There has been a suspicion for many years¹ that the material standing in American collections as *Aristotelia rubidella* and *A. pudibundella* represented a considerable number of similar but definitely characterized species. The need for a correct determination of the Porto Rican species reported by Walsingham under these names necessitated some more definite action and led to a review of the material standing in several collections under those names.

There is no attempt here to make the study complete, but merely to identify these two species definitely and clear up some material that was actually confused with them. For a real revision of the group the material standing as *fungivorella* and as *roseosuffusella* would also have to be gone over, as they also include several species, some of which have been recently described by Braun and Meyrick. Two of these I had actually confused with *rubidella* and *pudibundella*, namely an undescribed close relative of *fungivorella*, which had been mistaken for *pudibundella*, and a southern form of *roseosuffusella* (the eastern clover species which commonly goes by that name) which had lost the white markings almost wholly, and so fitted rather closely to Zeller's original description of *pudibundella*.

I have examined the types of Zeller's *pudibundella*, Clemens's *rubidella*, and Chambers' *intermediella* and *rubensella*. Zeller's *molestella* is not at Cambridge, and no doubt is in the Zeller collection at London. It cannot be identified from the description alone, and may turn out the same as *intermediella*. I found in this type material there were three well characterized species, none of which were the Porto Rico species from which I started, and which Walsingham had used to recharacterize *rubidella*.

¹ See Busck, Proc. U. S. Nat. Mus. 25: 797; Forbes Lep. N. Y. 296.

and perhaps *pudibundella*. Zeller's types of *pudibundella* from Texas were a species that we had not previously recognized, but his Massachusetts types agreed with Clemens's unique type of *rubidella*. Clemens's species was very distinct and generally correctly named, but was a species that did not have the secondary sexual characters given it by Walsingham, who seems to have had only the West Indian species (*diolcella* Forbes). The types of *intermediella* agree so far as can be told (lacking an abdomen) with the species which Miss Murtfeldt bred from apple and called *intermediella*, but were very different from either the species which Busck or I had identified as *pudibundella*, to which Busck sank the species. On the other hand there is an oak species which Miss Murtfeldt had standing as *rubensella*, which I cannot distinguish structurally from the apple species. Chambers' single surviving type of *rubensella* is the same as the apple species, so far as one can see; but other material Chambers had determined as *rubensella*, and standing beside it in the M. C. Z. collection was *rubidella*, thus explaining Busck's misidentification of 1903. The type also lacks an abdomen and the name cannot be finally fixed, as there is no food record to help us, so the name should certainly be allowed to lapse. In strict interpretation it should perhaps have priority over *intermediella*, which itself may eventually turn out to be *molestella* Zeller.

There are two rather distinct subgroups represented in this material, the first with *rubidella* and *diolcella* well defined, the other, with *pudibundella*, *intermediella*, the Porto Rican new species *vagabundella*, etc., less sharply defined, and grading off into *fungivorella* on one side and *roseosuffusella* on the other. The two groups may be characterized as follows:

A. Outer part of antenna with five white rings or dots on alternate segments; fore tarsus with a white ring on third as well as first two segments; markings of fore wing normally obscure and confused, of gray and blackish with some scattered rose scaling. Male with conspicuous sex-scaling on fore wing below; uncus scoop-shaped; valve spatulate but undivided; saccus more slender, not extended in a double juxta-like process to support the penis Subgroup *Rubidella*.

B. Outer part of antenna plain, or with a white scale on each segment; fore tarsus with two rings on first segment and one on

second, but none on third; fore wing normally with contrasting oblique brown fasciae and broad areas of yellow or rose or both. Male without sex-scaling or with some obscure and diffuse scaling on hind wing; uncus simple, a curved cone or acute at apex; valve simple and slender (bifurcate in the outlying *roseosuffusella* group); saccus more massive, and penis supported by an angular chitinization except in *intermediella*, in which the penis itself is very large and angular Subgroup *Pudibundella*.

KEY TO THE SPECIES CONSIDERED—MALE CHARACTERS

1. Fore wing with sex-scaling below; uncus scoop-shaped, open at the end; valve spatulate.....2.
Fore wing without sex-scaling below; uncus tapering, if hollow beneath closed at the end by the strong down curve of the pointed tip; valve slender or notched at apex.....3.
2. Valve more slender, the angulation on its lower edge half way out; fore wing below with costal edge plaited and heavily covered with pale sex-scales so that it appears double; hind wing at costa with a large hair-pencil, received in a groove in fore wing below cell (Porto Rico, etc.)*diolcella*.
Valve with end much broadened, the angulation on its lower edge located near apex; fore wing below with a triangular area of blackish sex-scaling near base, normally followed and rarely replaced by pale sex-scaling; no hair-pencil or grooves.....*rubidella*.²
3. Valve broad and notched at apex (Figs. 2, 3). Subgroup *Roseosuffusella*.
Valve slender, linear4.
4. Penis very broad and stout, scoop-shaped at the end, the left side of the scoop raised in a broad blade; no juxta.....5.
Penis nearly cylindrical or conical, slender, at least toward tip; supported by a double triangular chitinization functioning as a juxta, though perhaps a derivative of the saccus.....6.
5. Structures more slender, valves straighter, subscaphium acute (Fig. 4).
intermediella.
Structures stouter, valve upcurved, subscaphium blunt at end (Fig. 5) (Mexico)*squamigera*.
6. Subscaphium very slender and sharp, less than $\frac{1}{3}$ as long as valve; penis with an extra somewhat sheath-like chitinization on dorsal side, suggesting the modification of *A. roseosuffusella* (Fig. 6).....*pudibundella*.
Subscaphium longer and stouter, nearly half as long as valve; penis simple7.
7. Subscaphium pointed, simply curved, lower side of tegumen with a curving concave patch of fine bristles; membrane between 8th segment and

² In *A. corallina* of Mexico, which is an outlier of this group, the point on the valve has moved out to form its actual apex, and the rounded apex has become wholly dorsal (Fig. 1); there is no sex-scaling.

genitalia with a complicated mass of expansile scales, which show as a pale mass at the end of the abdomen in the intact insect.

vagabundella.

Subscaphium blunt, S-shaped; tegumen without patch of bristles; expansile tufts at base of genitalia reduced to a few deciduous hairs, inconspicuous8.

8. Valve short and abruptly narrowing; penis also very short and stout (Fig. 7).....*ivae*.

Valve with outer part linear or nearly so; penis slender, spine-like (Figs. 8, 9).....Subgroup *Fungivorella*.

PARTIAL KEY TO SPECIES—SUPERFICIAL CHARACTERS

1. Fore wing suffused, particularly on outer half, where it is practically immaculate; Indian red.....*salicifungiella*.
Fore wing with complex markings on outer part, or a confused mixture of scales of two or more contrasting colors.....2.
2. Outer ten segments of antenna with five white bars on alternate segments, obscurer species.....3.
Outer ten segments not specially marked; wings as a rule with more contrasting markings.....4.
3. A sixth bar on antenna, three segments before the fifth one from apex; almost all the light markings rose, even the bars on palpi being rose*diolcella*.
No sixth white bar on antenna; bars on palpi white; fore wing frequently marked with some white, at least the bars in the apical fringe being white.....*rubidella*.
4. Third segment of palpus very long, mostly with fine black and white longitudinal stripes; a transverse black and white ring at base; fore wing *normally* extensively marked with white, and with a white apical spot.....Subgroup *Roseosuffusella*.
Third segment of palpus stouter, as a rule but little longer than second segment, with three transverse bands each of black and white; fore wing with little white, and never with a white apical spot.....5.
5. Apical fringe subcaudate, crossed by a curved longitudinal black streak and white bar (very variable in intensity)Group *Fungivorella*.
Apical fringe with transverse striping only.....6.³
6. Antenna with a contrasting white scale or two on each segment, blackish otherwise; antemedial band not extended out in middle of wing, but followed by a separate blackish spot in the fold, which may be obscured by the general dark ground color; fore wing with a tendency to iridescence7.

³ The following species are only partly determinable on superficial characters and the male genitalia must always be considered. *A. ivae* also belongs to this group, but I haven't sufficient data to place it in the key.

- Antenna dull fuscous, with alternate whorls somewhat paler but no contrasting white spots; second fascia extended far out in fold, incorporating the following black dot; ground nearly evenly fuscous, with a little ochre opposite the two middle fasciae (Texas).....*pudivundella*.
7. Ground with a decided violet or rose iridescence, in light specimens with buff head and thorax, with a strong rose iridescence; discal spot at end of cell partly cut off from the third fascia as a rule (Mississippi Valley and Southwest)*intermediella*.
- Ground blackish, normally so dark as to conceal the black spot in the fold; the dorsal region more or less ochre, with golden iridescence in a favorable light (Porto Rico).....*vagabundella*.

A. diolcella Forbes

- Eucatoptus rubidella* Walsingham, Proc. Zool. Soc. 1897, 70;
Aristotelia r. Forbes, Sci. Surv. Porto Rico xii, 116, 1930.
Aristotelia diolcella Forbes, Jour. Dept. Agr. P. R. xv, 366, 1931,
 Pl. 42, fig. 13; 47, Fig. 42 (male genitalia).
 (Not *Aristotelia rubidella* Clemens)

Very close at first glance to the North American *A. rubidella* with which Walsingham confused it, but easily separated in the male by the sex-scaling and pencil. Walsingham transferred *A. rubidella* to *Eucatoptus* on the basis of this species; in fact the true *rubidella* has no hair-pencil. Besides Porto Rico the species is found in the Virgin Islands and Lesser Antilles.

A. rubidella Clemens

- Gelechia rubidella* Clemens, Proc. Nat. Sci. Phil. xii, 163, 434,
 1860. *Aristotelia r.* auct. in part.
 (Not *Eucatoptus rubidella* Walsingham, Proc. Zool. Soc. 1897,
 70, which is *A. diolcella*).

The type of this species in Philadelphia is a female, but it shows the characteristic barred antenna and fore tarsus, and is completely congruent in appearance, so I believe there is no question of identification. The corresponding male does not have the hair-pencil which both Walsingham and Busek used as the special character of the species, but which exists only in the related Antillian one; in fact I know of no mainland species which does have the pencil.

The species differs from others on the mainland in the general scattering of pink flecks on a generally dark wing with confused markings, a character more emphasized in *A. diolcella*. The group characters will also separate it from the other mainland species, *corallina* alone having a similar fore tarsus and genitalia, but being easily separated by the continuous pink and white dorsal stripe. The secondary sex-scaling on the fore wing varies a great deal without any corresponding variation in genitalia; typically there is a triangular patch of blackish scales followed by a less definite, similar straw area, but the straw area may be lost, and a Florida specimen shows the two colors almost reversed, the dark area being enclosed in a large cream area which extends across the base of the wing and out along both margins to the middle. Some of these variations may mark good local forms.

A. rubidella is the only one of the three species common in the east, and practically all eastern records should be credited to it; including Zeller's Massachusetts types of *pudibundella*. There is a single *intermediella* in the Dietz collection labelled "East River, Conn.," but the record should be verified.

I have the following records: Labelle, Florida, May 8-10, 1916 (Bradley); Silver Lake, Chesham, N. H., July 1930 (Klots); Ithaca and McLean, N. Y., July-Aug., not rare; Rock City, N. Y., July 4; Monteagle, Tenn., Aug., 1930 (Richards); Biloxi, Miss., June 13, 1917 (Bradley).

A. pudibundella Zeller

Gelechia pudibundella Zeller, Verh. zool.-bot. Ges. Wien, xxiii, 273, 1873 (in part, Texas material only); Walsingham, Trans. Am. Ent. Soc., x, 181, 1882; *Aristotelia p.* Buseck, Proc. U. S. Nat. Mus. xxv, 796, 1903 (in part, not synonyms or life history).

(Not *Aristotelia pudibundella* Walsingham, Proc. Zool. Soc., 1897, 66, nor Forbes, Lep. N. Y., 295, 1924, nor Sci. Surv. P. R., xii, 116, 1930.)

This species must be limited to the Texas types, the Massachusetts ones surviving in the U. S. National Museum being *A. rubidella* Clemens. Zeller's description was obviously composite, being based primarily on the Texas material, but referring to the

extensive pink markings which are found only in *rubidella*. All the material in several collections I have seen with this name belongs to other species, and I have characterized it entirely from the Texas types in Cambridge and Washington, of which there are 11, several in good condition. The one at the head of the series in Cambridge has some right to be considered the holotype, and as it has preserved its abdomen and is a male, I have mounted the genitalia (Fig. 6) and marked it "lectotype." Superficially it is practically indistinguishable from a small Texas member of the *fungivorella* group (which however shows traces of the black and white apical bar of that group), from *A. ivae* Busek, and from *A. intermediella* Chambers, which is the species most frequently passing for it. The genitalia, however, are perfectly distinct in each case. The nearest thing to a superficial character to separate it from the others is the nearly plain antenna, also shared by the Texas *fungivorella*, but the character seems to have some exceptions. In the genitalia it comes nearer to *roseosuffusella* than any other member of its group, showing the characteristic very small, curved and sharply pointed subscaphium, and the irregular chitization on the dorsal side of the penis, but the slender valve is as in other members of this subgroup, the valve also has a rough swelling and mass of short bristles about $\frac{1}{3}$ way out, which seems limited to the species.

A. vagabundella Forbes

Aristotelia pudibundella Walsingham, Proc. Zool. Soc. 1897, 66;
Forbes, Sci. Surv. P. R. xii, 116, 1930.

Aristotelia vagabundella Forbes, Jour. Dept. Agr. P. R. xv, 365,
1931, Pl. 42, Fig. 12; 47, Figs. 40, 41 (male genitalia).

(Not *Aristotelia pudibundella* Zeller)

I have described this species in the paper cited in the Journal Dept. Agr. P. R. It is decidedly close to *pudibundella* on the one hand and to *ivae* on the other, but abundantly distinct in genitalia. The yellow gloss when distinct seems characteristic, but sometimes is obsolete, especially in rubbed specimens. The yellow anal tuft is absolutely diagnostic of the male, and apparently can always be seen. It is only known from Porto Rico and the Virgin Islands.

A. *intermediella* Chambers

?? *Gelechia modestella* Zeller, Verh. z.-b. Ges. Wien, xxiii, 274, 1873; *Aristotelia m.* Busck, Proc. U. S. Nat. Mus. xxv, 797, 1903.

Gelechia intermediella Chambers, Bull. U. S. Geol. Geog. Surv. Terr. iv, 89, 144, 1878; Murtfeldt, Bull. U. S. Dept. Agr. Div. Ent. xxiii, 53, 1871.

Gelechia rubensella Chambers, Can. Ent. iv, 193, 1872 (in part); Murtfeldt, Can. Ent. vi, 222, 1874 (variety).

There are two forms of this species, with identical pattern and genitalia but differing in coloring and food-plant,—an apple phase with purple iridescence, and a paler oak phase with rose iridescence. Chambers' marked types of *intermediella* and *rubensella* are both of the purple phase, and apparently not bred; they have both lost their abdomens. The genitalic characters were investigated on one of Miss Murtfeldt's original apple breeding, which is obviously identical with the Chambers types, and a specimen from the Murtfeldt collection of the rose colored phase without data, but most probably of the original oak breeding (Fig. 4); since the only specimen with her oak breeding number had lost the abdomen. The Cornell collection has also a still paler form with identical genitalia from Gillett, Texas, June 25, 1917 (Bradley). It is caught, but may turn out to be a third food-variety when bred. The surviving type of *intermediella* is from Texas, and of *rubensella* from Kentucky, by their labels, which are presumably correct, but not original, as the material was, I understand, received at the M. C. Z. in pill-boxes and mounted there.

The characters of this species are difficult to put in words, but not so difficult to recognize; in fact, it looks more distinct than *fungivorella* or *ivæ* from *pudibundella*, at first glance. It is the one that Busck has had mainly in mind in determining *pudibundella*.

A. squamigera Walsingham, of which Mr. Busck has allowed me to examine a paratype (Fig. 5), has a similar deformed penis but a different valve. It must be very close to *intermediella*.

A. *roseosuffusella* Clemens

This species is usually considered easily determinable by the contrasting white apical spot, and clear white areas of ground generally (a character shared by a couple of the recently described close relatives). We have a strain from the Gulf Strip which has largely lost these white areas, and looks remarkably like the light forms of *intermediella*. The simplest discriminating character is the long longitudinally striped third segment of the palpus, as in other members of the *roseosuffusella* group. The fore wing is brown-banded on a light powdery gray base, much mixed with pink and yellow; and the thorax is light brown, with contrasting blackish tegulae, a little more prominent than in the light forms of *intermediella*. Males usually have the genitalia (Fig. 2) sufficiently extruded to show the broadly expanded and notched tips of the valves, which are identically as in *roseosuffusella*. The University collection has specimens from La Place, Ala., June 9, 1917, Leroy, Ala., June 11, 1917, and Victoria, Texas, June 24, 1917, all collected by Bradley.

A. *fungivorella* Clemens

This species is typical of a little group characterized superficially by the strikingly marked apical fringe, and in the genitalia by the blunt S-curved subscaphium, combined with most of the other characters of *pudibundella*. There are at least three species, and I am not sure which is the true *fungivorella*. I figure the genitalia of two of them (Figs. 8, 9).

A. *salicifungiella* Clemens

A very striking thing, which seems to have been confused with *fungivorella* merely on account of the similar food. It appears almost solidly brick red, and has almost the identical markings of the South American *Empedaula*; but the palpi are slender and pointed as in other Aristotelias. I have not seen the genitalia; in fact, know of only two specimens—the type, supposed to be from Pennsylvania, and a specimen in the M. C. Z. from Iowa City, Ia., July 18, 1898 (Wickham).

PLATE XX

Male genitalia of species of *Aristotelia*. The penes are in most cases drawn separately and placed at the right or below the main figures.

Figure 1. *A. corallina*.

Figure 2. *A. roseosuffusella*.

Figure 3. *A. psoraleae* (slide by Busek from specimen in the U. S. National Museum).

Figure 4. *A. intermediella*.

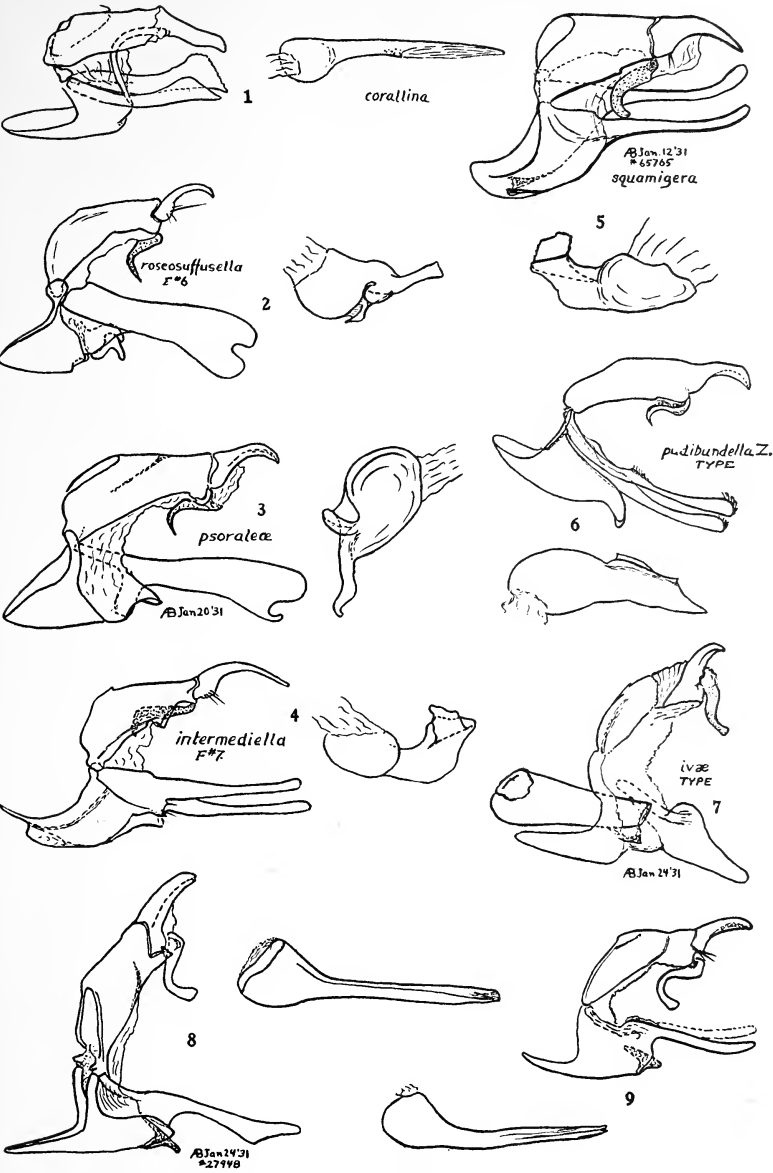
Figure 5. *A. squamigera* (slide by Busek from specimen in the U. S. National Museum).

Figure 6. *A. pudibundella* (lectotype in the Museum of Comparative Zoology, Cambridge).

Figure 7. *A. ivae* (slide by Busek of type in the U. S. National Museum).

Figure 8. *Aristotelia*, group *fungivorella* (slide by Busek of specimen in the U. S. National Museum).

Figure 9. *Aristotelia*, group *fungivorella* (Texas specimen, superficially very close to *A. pudibundella*).



ARISTOTELIA

NEW AND LITTLE-KNOWN COLORADO DIPTERA

BY MAURICE T. JAMES

BOMBYLIIDÆ

Eclimus muricatus (O. S.) (*Epibates muricatus* O. S., West. Dipt., 272.) The following specimen, taken at Manitou, Colo., June 15, 1929 (M. T. James), fits the description of Osten Sacken's species, which was described from a single male.

Male. Length, 14 mm. Entire body black, largely velvety and opaque, the front and sternum somewhat shining. Antennæ long, black, the second joint short, the third joint nearly as long as the first two combined. Proboscis elongate, with long, narrow labia; palpi long, about half the length of the proboscis, prominent, distinctly two-jointed. Thorax beset with sharp rigid spines on the dorsum, which are conspicuous, and in four rather distinct rows; they vary in size from small to quite large, and are mostly pre-sutural. Thorax devoid of bristles. Wings strongly infumated, more so near the veins, and becoming gradually darker toward the costal margin, the costal cell becoming quite deeply brown. Costa beset with quite distinct teeth in two distinct rows. Legs long, black, the front tarsi somewhat lighter, brownish below. Halteres black. Head, thorax, abdomen, and femora clothed with black pile, which is less dense, but, nevertheless, present, on the dorsum of the thorax; bristles of tibiæ and tarsi black.

The female lacks the tubercles on the mesonotum and costa and has a broad, shining black front and more robust abdomen. Two females from Cascade, Colo., July 9, 1914, and one from California, in the American Museum of Natural History.

STRATIOMYIDÆ

Odontomyia similis Johnson. I am referring the following specimen from the collection of the Colorado Agricultural College, taken on Cameron Pass, Colo., June 5, 1931 (C. R. Jones, ?) to this species, which was described from a single female.

Female. Length, 10 mm. Head and occiput yellow; ocellar triangle black; vertex, a spot on each side of the front, a median frontal stripe from the base of the antennæ half-way to the occipital triangle, and a large spot at the base of the antennæ, all black. Antennæ black, the first joint twice the length of the second; proboscis black. Dorsum of thorax black, its posterior angles yellow; scutellum yellow; spines yellow, short, upcurved. Pleura green, with two black spots, the anterior one touching the black pectus. Abdomen black, except for the following marks, which are green: a triangular spot on each side at the posterior margin of the second segment; a pair of bands in a similar position on the third and another, but much shorter pair, on the fourth; a narrow abdominal margin, considerably widened at the posterior margin of the fifth segment. Venter green. Halteres green. Femora, except base, black; bases of tibiæ and of tarsal segments black; remainder of legs yellow. Wings hyaline; veins strong, yellow. Third vein simple; discal cell emits three distinct veins.

The abdominal markings in this specimen are greenish, rather than yellow, as in Johnson's description of the type; but, as Johnson remarks, this is of little consequence. Fresh specimens of *Odontomyia* seem to have green markings that turn yellow with age.

***Odontomyia nuda* new species**

Scutellum unspined; abdomen with an irregular black dorsal line and a yellow border.

Female. Head and occiput yellow, with sparse yellow pubescence; vertical triangle black; a rounded black spot on each side of the front, below the vertical triangle, and another just below the base of the antennæ; proboscis black. Antennæ missing in type. Dorsum of thorax wholly black, except for posterior angles, and with short yellow pubescence; tergum yellow; pectus black. Scutellum wholly yellow, with black pubescence above; unspined. Halteres yellow. Metascutellum black, not prominent. Abdomen yellow in ground color; a series of broadly-connected diamond-shaped black spots on the center of the segments, forming a continuous line, the spot on the fifth segment nearly attaining the lateral margin, broader than the others; a small black spot near each lateral margin of the third segment, a larger one, briefly connected with the central spot, in the same position on the fourth segment; apex of fifth segment yellow. Venter yellow.

Femora except tip, and distal half of tibiæ, black, femora slightly yellowish beneath; tip of femora, proximal half of tibiæ, and tarsi, chiefly yellow; terminal tarsal joints brownish. Wings hyaline, veins yellow; third vein distinctly forked; discal cell emits three distinct veinlets.

One specimen in the collection of the Colorado Agricultural College, female, Maybell, Colo., Aug. 1, 1904. (Collector unknown.)

This species is related to *O. nigrirostris* Loew and to *O. fallax* Johnson. The abdominal markings will readily distinguish it from both these species.

***Odontomyia alticola*, new species**

This species is closely related to *O. arcuata*, and descriptions of *O. arcuata* apply to this species, with the following exceptions; the face is wholly yellow or green in both sexes; the scutellum, in the females, is wholly yellow or green and covered with thin pile which, in some specimens, becomes blackish toward the base; in the males, the black at the base of the scutellum is narrower than in *O. arcuata*; the yellow of the occiput, in the females, is more extended, the black region being confined to the borders of the occipital fossa; the abdominal markings of the female consist of subtriangular markings on the second, third, fourth, and fifth segments, all rounded at the posterior angles, all black; that of the second segment joins broadly to the marking of the first segment, which consists of a narrower band along the posterior margin; those of the third and fourth are greatly attenuated at the lateral margins, and touch the anterior margins of the segments only narrowly at the middle and at the extremities; that of the fifth indented posteriorly; none of these markings are connected with the others, except for the connection between the first and the second. Several specimens of this species were labeled "*O. arcuata*" together with other true specimens of *O. arcuata* in the Colorado Agricultural College collection; but, though *O. arcuata* is an extremely variable species, I believe these specimens of *O. alticola* constitute a distinct species, or at least subspecies, by virtue of the stability of this variation in the same locality. Johnson (Trans. Amer. Ent. Soc., xxii, 256) probably had specimens of this species before him when he wrote: "In the ten specimens before me this character (*i.e.*, the lack of the biarcuate edge) predominates, although it is not typical; in one specimen which very closely resembles the type the marking of the second segment is triangular, and on the other segments the biarcuate edge is wanting, and the anterior edge does not quite reach the margin of the segment toward the lateral portions." I am somewhat dubious as to the males, but I have referred those having the face entirely yellow to *O. alticola* and those having the upper part of the face, toward the base of the antennæ, black, to *O. arcuata*.

Types.—Holotype, female, allotype, male, Fort Collins, Colo., June 23, 1931. Paratypes, 5 females, 3 males, Fort Collins, June 23, 24, 25, 27, 28, 1931; 2 females, Canon City, Colo., June 25, 1931; 1 male, Clifton, Colo., June 9, 1911; 1 male, Delta, Colo., June 28, 1912; 6 females, "Colo.," no date (all in the collection of the Colorado Agricultural College, collectors unknown); 1 female, Boulder, Colo. (C. P. Custer), July 4, 1925 (Colorado University Collection).

DOCTOR OTTOLENGUI'S COLLECTION OF PHYTOMETRINÆ

BY FRANK E. WATSON

AMERICAN MUSEUM OF NATURAL HISTORY

The members of the New York Entomological Society¹ will be interested to learn that Dr. R. Ottolengui has donated his very excellent collection of Phytometrinæ to this Museum. The older members will remember that Dr. Ottolengui specialized in this subfamily of the Noctuidæ, and published an extensive paper in our JOURNAL entitled—"Plusia and Allied Genera with Descriptions of New Species," 1902, Vol. X, No. 2, pp. 57-77, Pls. vi-ix.

This collection is very complete and world-wide in scope. It contains about 3,300 specimens, representing nearly 450 species, and includes types, paratypes, metatypes, and homotypes. A great deal of the material is fresh and beautiful, the specimens looking as if bred. Many of the series are long. Individuals used for figuring in his published papers are so labeled.

Accompanying the collection is an album containing 171 hand colored sketches of types and other rare species.

Dr. Ottolengui's collection is now incorporated in that of the Museum and is available to students.

¹ Read at the meeting of Dec. 15, 1931.

NEW GENERA AND SPECIES OF OLD WORLD OESTROMUSCOID FLIES

BY CHARLES H. T. TOWNSEND

The following are descriptions of the Old World forms originally prepared for inclusion in the paper "Revised Classification of Oestromuscid Flies with Generic Synonymy of the Group," but finally reserved for separate publication. The taxonomic arrangement agrees with the revised classification given in the above paper. An outline of this is contained in my "Notes on American Oestromuscid Types" (Revista de Entomologia, Nos. 1 & 2), to which the student is referred for further particulars.

MUSCIDÆ

MUSCINI

Scutellorthellia gen. nov.—Genotype, *Musca lauta* Wied—Java

Runs out with *Orthellia* RD. Head extremely flattened and the frontal profile so strongly sloped as to be nearly in line with facial; clypeus gently sunk, cuplike, two and one-half times as long as wide; epistoma distinctly but not well narrowed from clypeus, short and in clypeal warp; haustellum little longer than labella, first antennal joint flush; eyes nearly bare, facets of upper two-thirds greatly enlarged in male; female vertex-width well over one-third head-width and front nearly uniform width, male front pinched out by contiguous eyes, IVRS straight, no FRO nor OCS in either sex, female parafrontalia polished metallic, parafacialia bare, cheeks fully one-third eye-length, mesoscutum and scutellum clothed with fine short hair, scutellum much swollen especially in male; postalar wall, tympanic pit and propleura bare; tympanic ridge and prosternum bristled, greater ampulla large and raised, 1 PA, no IPAL, PTL thickly-set short hairs, HPL thinly-set short hairs, RM ciliate inside above with 1 or 2 hairs and bearing 1 or 2 setæ on its inferior proximal process, 5R open length of R6 before wingtip, R5 bristled halfway to tip below with sparse and very delicate hairs but bare above; male squamæ much enlarged, elongate, widened behind, outer hind corner arcuate; flexor surface of midtibiæ with a strong bristle below middle; abdomen metallic, thickly set with erect black pile in male; ventral membrane exposed.—Female holotype, Copenhagen.

RHINIIDÆ

RHINIINI

Trichoberia gen. nov.—Genotype, *T. rufopilosa* sp. nov.—Guinea

Runs out with *Beria* RD. Head well swollen and inflated, frontal profile arcuate and one-third longer than facial, clypeus nearly flush, no facial

carina; epistoma Phasia-like, full width and nearly three-fourths length of clypeus; haustellum stout, palpi widened and flattened, antennæ widely separated at base, first antennal joint flush, arista bare, eyes bare; male vertex-width one-ninth head-width, front nearly uniform width on posterior third, widening to nearly half head-width at base antennæ; IVRS decussate, OCS short and proclinate, parafacialia scatteringly setose above, cheeks three-fifths eye-length, head and thoracic bristles normal, whole thorax and scutellum thickly clothed with long pile, venter and base of abdomen with shorter and thinner pile, 5 PA, 4 PS, 2 ST, 1 black PTL, HPL only yellow pile, 5R open over length of R6 before wingtip, R5 bare, RM yellow-pilose above; abdomen only a little longer than wide, no MM on any segments; second male sternite fully exposed and overlapping tergite, third and fourth widely exposed but overlapped by tergites, no ventral membrane; male fifth sternite deeply cleft.

Trichoberia rufopilosa sp. nov.—1 male, Guinea

Length, 9 mm. Wholly yellowish-testaceous, dorsum of abdomen with thin coat of tawny pollen; pile of thorax and scutellum light rufous, becoming more yellowish on pleura; frontalia, antennæ, palpi and legs fulvous, tibiae somewhat darker, tarsi blackish; wings clear, squamæ concolorous with body.—Male holotype, Copenhagen (Westermann Coll.).

Chlorrhynchomyia gen. nov.—Genotype, *C. clausa* sp. nov.—Ceylon

Runs out with *Eurhynchomyia* Mall. Head nearly half again as wide as high, frontal profile arcuate and one-third longer than facial, clypeus nearly flush, no facial carina; epistoma Phasia-like, well sprung nasutely and broad, fully one-third as long as wide; haustellum two-fifths head-height; palpi flattened, wide and thin; antennæ approximated at base, first joint flush; arista long-pubescent halfway, eyes bare; IVRS straight and short, not long enough to meet; 4 short PFRO in female, OCS proclinate-divaricate, parafacialia faintly micro-pubescent, cheeks nearly half eye-length; postalar wall, tympanic ridge and pit bare; prosternum bristled, propleura pilose, 4 PS, 2 ST, no IPAL, PTL very short, 5R closed length of R6 before wingtip, R6 far outside tip of R1, cubitus arcuate; female second sternite overlapping tergite, third and fourth covered.

Chlorrhynchomyia clausa sp. nov.—6 females, Ceylon (Horn)

Length, $4\frac{1}{2}$ to 5 mm. Yellowish; parafrontalia and parafacialia yellowish pollinose, former dotted with brown; frontalia, antennæ and palpi fulvous-yellow; proboscis black, vertex faintly greenish beneath pollen, portions of occiput next eyes blackish, faint to large black spot on cheeks; thorax wholly metallic bright green, tip and edges of abdomen forward to second segment same color, black median vitta on abdomen; legs pale yellowish, femora metallic green, tibiae and tarsi tipped with blackish; wings pale yellowish on costa, tipped with smoky-black; squamæ pale yellowish.—Female holotype, Berlin-Dahlem; female paratype, Lima.

CALLIPHORIDÆ

CALLIPHORINI

Africomusca gen. nov.—Genotype, *Tachina westermanni* Wied—Cape Good Hope

Runs out with *Ochromelinda* Vill. No facial carina, epistoma full width and warped, facialia strongly ciliate over halfway, proboscis equal to head-height, haustellum not bulblike, palpi clavate, base antennæ a little below eye-middle, arista long-plumose three-fifths way or so, eyes bare and nearly contiguous in male, IVRS strong and decussate, OCS long and proclinate, ocellar triangle bristled, parafacialia pilose on upper half; 3 PA, PS and ST; 2 PRA, wings clear, 5R open over length of R6 before wingtip, cubitus angular and acute, squamæ pilose above; abdomen metallic violet-blue with yellow apex, first segment shorter than others and without MM, 1 MM on second segment, 1 MD on intermediate segments, MR on last two segments, DR on anal segment.—Male holotype and paratype, Copenhagen (Westermann Coll.)—(*T. westermanni* RD nec Wied was evidently a very distinct form).

Adichosiops gen. nov.—Genotype, *Musca quadrimaculata* Swed—New Zealand

Runs out with *Ptilonesia* Bezz. Head a little wider than high, frontal profile flat and very sloped, clypeus sunk, no facial carina; epistoma elongate, narrowed from clypeus and warped; facialia ciliate high and bowed, vibrissal axis somewhat longer than antennal, haustellum one-third head-height, palpi with swollen tip in female and long-haired below, first antennal joint flush, arista long-plumose nearly three-fourths way, eyes thickly pilose, IVRS decussate at tips, 2 PFRO in female, frontalia densely pilose; parafacialia two-thirds width of clypeus, thickly short-pilose on callus at base antennæ and bare below; cheeks half eye-length, postalar wall thickly pilose, tympanic ridge bare, prosternum and propleura pilose, greater ampulla brown and bare, 3 PS and PA, 2 ST, no IPAL, PTL only pile, 6 to 7 pairs LS, wings clear, RM bare, preepaulet and subepaulet yellow, epaulet brown, squamæ black and black-pilose on disk; abdomen wholly metallic blue to violet, intermediate segments with MR of short thickly-set appressed bristles, sternites widely exposed, no ventral membrane.—Female holotype, London (Brit. Mus.)—(*Musca sacra* Fab. is synonym—female holotype, Copenhagen, labelled “ex Cap. b. sp.” probably in error).

STEPHANOSTOMATIDÆ

STEPHANOSTOMATINI

Chrysosarcophaga gen. nov.—Genotype, *C. superba* sp. nov.—Solomon Islands

Runs out with *Phalacrodiscus* End. Body elongate, deep golden, not pilose; head a third wider than high; frontal profile nearly flat, faintly arcuate, strongly sloped, little longer than facial; clypeus slightly depressed

and twice as long as wide; epistoma wide, nearly full width of clypeus, short and considerably warped; facialia bristled over halfway, haustellum a third head-height or so, palpi heavy-clavate, vibrissal axis equal to antennal, arista long-plumose two-thirds way, female vertex-width one-fourth head-width, 2 FRS below base antennæ, IVRS strong and perhaps decussate, 2 strong PFRO in female; parafacialia half clypeal width, with 2 longer hairs below next eye continued in faint row of short microsetæ to vertex; cheeks a third eye-length, lateral plates of postscutellum setose, prosternum and propleura bare, prescutum nearly as long as postscutum and latter with flattened disk, 4 strong PS and PRS, 3 strong ST in line, no PH, IPAL differentiated and short, PTL 5 or 6 short; 3 LS, the HLS long and decussate, no APS, 1 strong DS; 5R open well before wingtip, R1 bare, R5 bristled to R6, M3 half its length from cubitulus; squamæ large, two-thirds as wide as long, inwardly approximated; no MM on first segment, 1 MM on second, MR on last two segments and on first hypopygial segment, sternites narrowly exposed, female sixth tergite incised on median line.

Chrysosarcophaga superba sp. nov.—1 female, Bougainville, Solomon Islands (Rechinger)

Length, 15 mm. Deep gold pollinose; frontalia, antennæ, palpi, two uninterrupted thoracic vittæ, line from humerus to wingbase, abdominal incisures and median line on first three segments, venter, hypopygium and legs black, third antennal joint with a brownish bloom; proboscis blackish; thoracic vittæ equal width, well defined, reaching nearly to front border of scutellum; wingveins bordered with smoky-yellow, squamæ white.—Female holotype, Vienna.

Eupseudosarcophaga gen. nov.—Genotype, *Sarcophila mamillata* Pand.—France

Runs out with *Pseudosarcophaga* Kram. Frontal profile faintly arcuate and nearly twice as long as facial, arista short-plumose halfway and basal joints short, male vertex-width one-sixth and female a third head-width, male front at base antennæ nearly a third head-width, FRS stopping at base antennæ, IVRS nearly meeting at tips, 2 PFRO in female and none in male, frontalia narrowed posteriorly in male, cheeks half eye-length, 1 PA, 3 PS and ST, 5R open, R1 bare, stump at cubitulus, no male tibiæ long-villous; abdomen of normal type, pollinose, not pilose, first sternite overlapping ends of first tergite, basal hypopygial segments of male large and each bearing two nipplelike processes.—Male holotype, Paris.

MILTOGRAMMINI

Synorbitomyia gen. nov.—Genotype, *Hoplcephala linearis* Vill.—Formosa

Runs out with *Sphecapatoeclea* Vill. Head one-fourth wider than high; frontal profile flat, strongly sloped, half to two-thirds longer than facial; epistoma warped and then extending downward in vertical plane, very nar-

rowed from clypeus and about as long as wide; V decussate, haustellum stout and little longer than labella, base antennæ on eye-middle and antennæ not separated at base, first antennal joint nearly flush, arista bare and thickened not halfway; eyes nearly bare, only thinly short-haired; female vertex-width over a third and male over a fourth head-width, face on middle half head-width; frontalia nearly to wholly covered by parafrontalia in male, at times covered anteriorly in female; parafrontalia strongly flattened as if pressed; parafacialia twice as wide as clypeus above, narrowed below, pubescent and with row of short setæ on inner edge; cheeks a third eye-length; postalar wall, tympanic ridge, prosternum and propleura bare; 3 PS, 4 ST, IPAL scarcely differentiated, several short PTL, venation strongly vorine, 5R narrowly open quite far before wingtip, last section of C1 nearly half length of preceding, cubitulus V-like and two-fifths wing-width from hind margin, M1 heavily bent in at base, M3 its length from cubitulus and bowed inward, stump at cubitulus; no MM on first segment, 1 strong approximated MM on second, MR on last two segments; second sternite overlapping tergite in both sexes, third and fourth triangularly exposed in male but mere tips showing in female.—Female holotype, Berlin-Dahlem.

Oestrosomomyia gen. nov.—Genotype, *Miltogramma globulare* Mg.—Germany

Runs out with *Oebalia* RD. Frontal profile flat and little over facial, clypeus deeply cuplike and nearly twice as long as wide; epistoma strongly narrowed from clypeus, nearly length of latter, widening below and somewhat warped; V strongly decussate and differentiated, proboscis as long as head-height, antennæ not separated at base, arista bare and thickened not halfway, eyes bare, female vertex-width a third head-width, IVRS straight, 2 PFRO in female set far back, parafacialia twice clypeal width and showing only faint microsetæ, cheeks nearly half eye-length; postalar wall, tympanic ridge and pit, lateral postscutellar plates, squamopleura, prosternum and propleura bare; 3 PS, 4 ST, no PH, 4 short PTL, 5R open, R5 bristled at base, R6 opposite R1 tip, last section of C1 not a third length of preceding section; squamæ well widened and subsquared behind, strongly projecting outside; female abdomen elongate-globular, deeper than wide, not so wide as thorax, nearly half again as long as wide, no MM on first segment, 1 erect MM on second and erect MR on last two segments; sternites 1 and 2 exposed and overlapping tergites, 3 to 5 partially exposed; first hypopygial tergite of female just showing above, convex superiorly and facing posteriorly.—Female holotype (?), Copenhagen.

Eumiltogramma gen. nov.—Genotype, *E. angustifrons* sp. nov.—Formosa

Runs out with *Miltogramma* Mg. Head scarcely wider than high and its profile irregularly semicircular, frontal profile strongly arcuate and two-thirds longer than facial, clypeus sunk cuplike; epistoma a third as wide as clypeus and a third as long as same, not twice as long as least width,

warped forward and then downward in vertical plane; V not longer than bristles next them, haustellum one-fifth head-height or so, antennae approximated at base, first antennal joint flush; arista very short, bare and thickened halfway; eyes bare, vertex-width in both sexes one-sixth head-width and front only slightly widening anteriorly, FRS stopping at base antennae and hugging frontalia, IVRS straight, no OCS, parafacialia not over two-thirds width of clypeus and faintly pale microsetose, cheeks one-eighth eye-length, no GNO, scutellum semicircular and nearly as long as wide; postalar wall, tympanic ridge, prosternum and propleura bare; no PRA, 4 to 7 short ST, no IPAL, bunch of short PTL, 5R widely open twice length of R6 before wingtip, R5 bristled at base, last section of C1 nearly a third length of preceding; squamæ large, as wide as long, widely rounded behind, projecting outside, inner corner an acute angle and subangular; no MM on first two segments, weak MR on third, stronger MR on anal segment; second sternite overlapping tergite, tips of third and fourth exposed in both sexes.

Eumiltogramma angustifrons sp. nov.—1 male and 5 females, Tainan, Macuyama and Takao, Formosa (Sauter)

Length, 6 to 9 mm. Head silvery-white; parafrontalia light gold, spreading more or less on parafacialia; frontalia pale golden-fuscous, antennae reddish-fulvous, palpi fulvous, occiput cinereous; thorax pale brassy pollinose, three equal wide black vittæ, a separate narrow vitta half as long on each side of the middle one anteriorly in female but largely confluent with latter in male; scutellum blackish, thinly pollinose on apical half; abdomen pale brassy-silvery, dorsum of first segment and median vitta and irregular posterior half of last three segments black; legs blackish, femora pollinose outside; wings extremely clear, glassy and transparent; squamæ pearly-white.—Female holotype, male allotype, Berlin-Dahlem; female paratype, Lima.

Thelodiscoprosopa gen. nov.—Genotype, *T. formosana* sp. nov.—Formosa

Runs out with *Craticulina* Bezz. Head nearly a third wider than high and its profile nearly semicircular, frontal profile sloped and half again as long as facial, clypeus deeply ovately dished and one-fourth longer than wide; epistoma in clypeal dish, narrowed from clypeus and half as long as wide; V decussate but little longer than bristles next them, proboscis short and stout, palpi slender and not thickened at tip in female, antennae approximated at base and latter little above eye-middle, first antennal joint minute and flush, arista and eyes bare, female vertex-width nearly half head-width and front uniform width nearly to base antennae, face widening evenly and over half head-width on middle, FRS stopping at base antennae, IVRS convergent, 3 equal PFRO in female, frontalia of female strongly widening posteriorly, OCS strong and proclinate-divaricate, parafacialia micropubescent and nearly as wide as clypeus, no FCO nor GNO, cheeks nearly a third eye-length; postalar wall, tympanic ridge, prosternum and propleura bare; 3 PS, 2 ST, 1 very weak PRA, IPAL scarcely developed,

2 short weak PTL, venation not vorine, costal spine quite strong, 5R open well before wingtip, R5 bristled at base, R6 opposite R1 tip, squamæ very wide and strongly projecting outside on posterior half, female abdomen ovate and tip pointed, no MM on first segment, 1 MM on second, MR on last two segments; second sternite overlapping tergite, third and fourth covered.

Thelodiscoprosopa formosana sp. nov.—1 female, Kankau, Formosa (Sauter)

Length, 6 mm. Whole body thickly silvery-white pollinose, frontalia greenish-yellow to sordid-yellow, pollinose; antennæ reddish-fulvous, third joint shading to brown, arista brown; palpi fulvous; 5 faint grayish thoracic vittæ, the three inner ones narrow; first segment black except narrow fleck of silvery each side, intermediate segments each with three polished black and more or less rounded triangles on posterior half or so, anal segments with the three triangles confluent in black tip; legs blackish, wings nearly clear, squamæ pure white.—Female holotype, Berlin-Dahlem.

Eumetopiops gen. nov.—Genotype, *Tachina fastuosa* Mg.—Germany

Runs out with *Sphenometopa* TT. Head nearly half again as wide as high, frontal profile strongly arcuately bulged and little longer than facial, clypeus very deeply sunk and nearly three times as long as wide; epistoma short and full width, strongly warped; facialia strongly but sparsely ciliate over halfway, V well differentiated and decussate, haustellum as long as labella, first antennal joint flush, arista bare and thickened nearly to tip, eyes bare, male vertex-width two-fifths head-width and front arcuately widened on middle, 2 FRS below base antennæ, IVRS straight, 3 PFRO in male; frontalia of male extremely widened posteriorly, convex, nearly uniform width on posterior half and almost filling vertex, silvered, thinly pilose on sides; OCS very weak in male, divaricate and faintly reclinate; para-facialia as wide as clypeus, narrowed below, bare except oblique row of short setæ; cheeks one-fourth eye-length, prosternum and propleura bare, no PRA, 3 PS, 2 ST, no IPAL, PTL a bunch of short hairs, wings maculate in male, venation not vorine, 5R narrowly open three-fourths length of M3 before wingtip, R5 bristled at base; squamæ very wide and long but not as wide as long, projecting outside somewhat, inner corner subangular; no MM on first segment, 1 MM on intermediate segments, MR on anal segment; first two sternites exposed, third and fourth covered.—Male holotype, Paris (?).

METOPINI

Chætancia gen. nov.—Genotype, *C. sauteri* sp. nov.—Formosa

Runs out with *Anicia* RD. Head a third wider than high and its profile nearly triangular, frontofacial profile acute especially in male and front strongly subconically produced, clypeus two and one-half times as long as wide; epistoma short, nearly full width and in warp of clypeal dish;

facialia steep, V long and decussate, haustellum little longer than labella, antennæ approximated at base and latter above eye-middle, first antennal joint nearly flush, arista bare and thickened a third way, eyes bare; front and face a third head-width in both sexes, both uniform width throughout except that face is slightly narrowed at oral margin level; IVRS straight, 2 PFRO and 3 RFRO in both sexes, frontalia full width throughout and widening posteriorly, parafacialia above as wide as frontalia on middle, prosternum and propleura bare, no A, 3 PS, 2 ST, IPAL a differentiated hair, several very short PTL, 5R narrowly open far before wingtip, R5 bristled halfway to tip, M3 midway and straight, squamæ well widened behind, male claws extremely short, no MM on first segment, 1 MM on intermediate segments, MR on anal segment; second sternite overlapping tergite, third and fourth triangularly exposed.

Chætania sauteri sp. nov.—1 male and 1 female, Toa Tsui Kutsu and Kankau, Formosa (Sauter)

Length, 6 mm. Head silvery-white, vertex faintly brassy, frontalia and antennæ blackish, palpi pale brownish; pleura silvery, mesoscutum and scutellum faintly brassy, four narrow brownish vittæ and a fifth between them behind suture; abdomen blackish, last three segments silvery on all but hind margins and median vitta of intermediate segments, the black of second segment expanding in median triangle but same less marked on third segment; legs blackish, wings faintly smoky-tinged, squamæ nearly white.—Female holotype, Berlin-Dahlem; male allotype, Lima.

MELANOPHORIDÆ

MELANOPHORINI

Parafeburia gen. nov.—Genotype, *Ocyptera maculata* Fall—Sweden

Runs out with *Melanophora* Mg. Head subdisklike and little wider than high, its profile flattened-circular; frontal profile arcuate and over half again as long as facial, oral profile strongly arcuate anteriorly and posteriorly, clypeus gently depressed; epistoma short, somewhat narrowed from clypeus and nearly in clypeal plane in male but somewhat warped forward in female; V differentiated, decussate and high above lower border of head; proboscis short, palpi filiform in male and slender-clavate in female, base antennæ far below eye-middle, third antennal joint little longer than the short second, arista short-pubescent nearly to tip and thickened only on base, eyes bare, vertex-width in male one-fourth and in female one-third of head-width, FRS stopping at base antennæ, IVRS not decussate, 2 PFRO in male and 2 to 3 in female, OCS proclinate, parafacialia bare and nearly in plane parallel to clypeal in male but somewhat oblique in female, cheeks two-fifths eye-length in male and wider in female; postalar wall, tympanic ridge and pit, lateral postscutellar plates, squamopleura, prosternum and propleura bare; 3 to 4 PS, 2 PA, 1 short PRA far from suture, 3 LS and no APS, strong costal spine; 5R long-petiolate, stalk as long as M3 and in

line with R5; latter bristled only at base, R6 beyond tip of R1, cubitus a third wingwidth from hind margin; squamæ narrow, little longer than wide, arcuately rounded behind and on corners; male abdomen elongate and cylindrical, female ovate, 1 MM on first segment, MR on second to fourth segments and no MD but the MM set forward from margin especially on anal segment, first hypopygial segment showing above in female as a fifth abdominal segment; male hypopygium ventral, anal forceps very slender and separated, fifth sternite not cleft nor emarginate but with straight hind edge.—Female holotype, male allotype, Stockholm (*Feburia rapida* RD is very distinct from this form).

OESTRIDÆ

OESTRINI

Hippooestrus gen. nov.—Genotype, *Rhinoestrus hippopotami* Grünb.—Cameroons

Runs out with *Rhinoestrus* B. Color yellowish-brown marked with silver, head much wider than high, facial carina vestigial, ocelli enlarged, parafacialia with colored tuberculate area extending in triangle from vertex to lunula, costa bearing a series of chitinized tubercles, 5R petiolate and the stalk distinctly curved upward from R5, R6 outside middle of 3M, M3 much nearer to cubitus and no stump at latter, squamæ very large, sternites comparatively narrow. Otherwise as in *Rhinoestrus* B.—Female fly holotype, male allotype, Brussels (State School Vet. Med.)—The anal stigmatic plates of the third-stage maggot are irregularly rounded in outline and present a microtuberculated surface enclosing an elongated button halfway between the center and the lower-inner margin.

ORMIINI

Phasioormia gen. nov.—Genotype, *P. pallida* sp. nov.—Malay Peninsula

Runs out with *Euphasiopteryx* TT. Head nearly as wide as high and its profile not semicircular, frontal profile strongly arcuate and little over facial in length, clypeus faintly depressed, no facial carina; epistoma a little narrowed, half as long as wide and continued in oral membrane, nearly in clypeal plane; facialia flattened nearly to clypeal plane, V twice length of bristles next them but not decussate, vibrissal area widened and thickly short-haired; proboscis greatly reduced, haustellum very short and labella very large, palpi stout-cylindric; first antennal joint nearly flush, third twice length of the elongate second joint; arista nearly twice length of antennæ, long-pubescent two-thirds way and short-pubescent the rest; eyes bare and upper three-fifths with very enlarged facets in male, female vertex-width a third head-width and front uniform width, male eyes contiguous from vertex to lunula, FRS stopping at base antennæ and diverging widely from frontalia anteriorly, IVRS absent in male and straight in female, 1 to 3 PFRO in female and none in male, ocelli absent, parafacialia bare and nearly in plane parallel to clypeal, cheeks a third eye-length; tympanic ridge, prosternum and propleura bare; prosternal membrane strongly in-

flated in both sexes, 3 PS and PA, middle PRA developed, 1 PRSA, no PH and no IPAL, epaulet concolorous with rest of wingbase and pleura, 5R open half length of R6 before wingtip, R1 and R5 bare, R6 nearly halfway between tips of S2 and R1; cubitus a right angle, angular and close to margin; M1 strongly and evenly arcuate inward, squamæ widely rounded on outer side and with sharply angular inner corner, no MM on first two segments, MR of very weak hairs on third, anal segment scatteringly covered with weak short hairs, ventral membrane covered, female hypopygium like *Ormia*.

Phasioormia pallida sp. nov.—1 male and 3 females, Singapore

Length, $9\frac{1}{2}$ to 10 mm. Wholly pallid fulvotestaceous including antennæ, palpi and legs; wings clear.—Female holotype, male allotype, London (Brit. Mus.).

TRIXINI

Rutilotrixa gen. nov.—Genotype, *Trixa lateralis* Walk.—Australia

Runs out with *Semiomyia* Mcq. Head profile not semicircular; frontal profile nearly flat, strongly sloped and a third longer than facial; face not shortened, clypeus well sunk on sides, facial carina low and sharply roof-like; epistoma somewhat narrowed and elongate, warped; facialia strongly bowed and obliquely flattened, haustellum little over a third head-height, rostrum well developed, labella very large; palpi heavily swollen in female, oval, mere bulbs on stalk as long as the swollen tip, thickly long-haired; antennæ not separated at base, first joint short, third one-fourth longer than second; arista thin and nearly twice length of antennæ, eyes bare, female vertex-width one-fourth head-width and front widening to half head-width at base of antennæ, FRS stopping at latter, 3 PFRO in female, parafacialia pilose above cheek-grooves and not as wide as clypeus, cheeks three-fifths eye-length and their grooves very large; tympanic ridge, lateral postscutellar plates, squamopleura, prosternum and its membrane bare and last not inflated; propleura pilose, 4 to 5 PS and PRS, 3 PRA far from suture, 3 ST, 2 PRSA in line, 5R open over length of R6 before wingtip, R5 bristled at base, no MM on first segment, 1 MM on second, 2 MD on intermediate segments, MR on third, anal stragglingly covered, sternites narrowly exposed and ventral membrane covered.—Female holotype, London (Brit. Mus.).

PHASIIDÆ

PHASIINI

Austrophasiopsis gen. nov.—Genotype, *A. formosensis* sp. nov.—Formosa

Runs out with *Austrophasia* TT. Head scarcely wider than high, circular in front view, flattened anteroposteriorly; frontal profile nearly flat, extremely sloped and nearly half again as long as facial; clypeus nearly flush, no facial carina; epistoma full width, one-fifth as long as wide and much shorter than clypeus, its edge flared; facialia bare, V weak but differentiated and decussate or tips meeting, vibrissal axis equal to antennal,

haustellum little longer than the moderately large and normal labella, rostrum developed, palpi minute, first antennal joint distinctly projecting but very short, second long and third little longer than second; arista bare; eyes bare, very obliquely set, nearly reaching vibrissal level but not obscuring the cheeks in profile; male vertex-width equal to width of ocellar triangle, that of female nearly a third head-width; FRS very weak and stopping short of base antennæ, IVRS short and decussate, OVRS barely differentiated in female; no OCS, postocellars, nor PVRs; parafacialia bare and nearly uniform width, cheeks over one-fifth eye-length; tympanic ridge, prosternum and propleura bare; PRA not well differentiated, 4 PS but front 2 weak, 2 PI, 2 weak ST and many hairs, no PST nor IPAL, 1 short weak PTL, wings clear, RM bare; 5R long-petiolate, stalk nearly or quite length of M3 and in line with downward curve of R5; M3 midway or nearer R6, cubitus a rounded obtuse angle, hind tibiæ not ciliate; abdomen short, rounded, little longer than wide, of 4 visible segments above in female, with differentiated but more or less hairlike bristles; sternites exposed, ventral membrane widely exposed in female but narrowly in male.

Austrophasiopsis formosensis sp. nov.—1 male and 13 females, Kosempo, Formosa (Sauter)

Length, 4 to 5½ mm. Head black, thinly silvery-white pollinose, blackish spot opposite base antennæ and another on middle of parafrontalia; frontalia and antennæ blackish, palpi dusky; thorax black, very thinly silvery pollinose, four faint black vittæ, inner pair very narrow; scutellum brown, entire abdomen orange-yellow; legs blackish, hind femora orange-yellow, middle femora yellow to brownish-fulvous; wings hyaline, squamæ watery tinged with smoky.—Female holotype, male allotype, Berlin-Dahlem; female paratype, Lima.

TRICHIOPODINI

Engelobogusia gen. nov.—Genotype, *Bogusia engeli* Karsch—Pungo Adongo

Runs out with Bogosiella Vill. Head a third wider than high; frontal profile flattened, well sloped, nearly a third longer than facial; clypeus nearly flush; epistoma full width, nearly half as long as clypeus and nasutely sprung; facialia flattened to clypeal plane and as wide as parafacialia, V long enough to meet, vibrissal axis three-fourths length of antennal, latter five-sixths head-height, haustellum little over one-fourth head-height, rostrum developed, labella normal, palpi slender-clavate and nearly as long as antennæ, first antennal joint nearly flush, third twice length of the somewhat elongate second joint; eyes bare, scalloped on lower two-thirds of posterior margin and reaching far short of lower border of head; female vertex-width over one-fourth head-width and face half head-width on middle, FRS stopping at base antennæ, no VRS, postocellars and PVRs nearly equal to FRS, female frontalia nearly three times width of one parafrontal in middle, strong proclinate-divaricate OCS somewhat stronger than FRS, parafacialia a little narrowed below and over a third

width of clypeus, cheeks over one-fourth eye-length; tympanic ridge, prosternum and propleura bare; lateral postscutellar plates setose, 2 PS, 1 ST, no PST and no IPAL, 1 moderately short PTL, 5R petiolate and stalk not as long as R6, R5 bare, squamæ squared behind and as wide as long, hind tibiæ not ciliate, abdomen elongate and of 6 visible segments above in female but fifth and sixth showing only hind edges, no distinctly differentiated erect MM, some LM on anal segment and first hypopygial and a weak MR on second hypopygial, sternites and ventral membrane exposed.—Female holotype, Berlin (Univ. Mus.); female paratype, Lima.

CYLINDROMYIINI

Prolophosia gen. nov.—Genotype, *P. petiolata* sp. nov.—South Africa

Runs out with Minthocyptera TT. Head as wide as high, its profile subquadrangular; frontal profile faintly arcuate, little sloped and three-fourths length of facial; clypeus nearly flush, even with facialia on median line and only slightly depressed on sides, nearly three times as long as wide; no facial carina; epistoma full width, very short and faintly warped; facialia flattened and fused with clypeus; V strong, long, decussate and set a little below median oral margin; haustellum short and swollen, rostrum developed, labella large, no palpi, vibrissal equal to antennal axis and latter three-fifths head-height, antennæ approximated at base and latter near upper level of eyes, first antennal joint erect and short, second little elongate, arista bare, eyes bare and strongly oblique, male vertex-width over one-fourth head-width and front widening to little over a third head-width at base antennæ, face a third head-width on upper half and faintly widening below; FRS 1 opposite base antennæ and 5 behind same, set close to frontalia; IVRS straight, OCS small, no postocellars, PVRs small; parafacialia bare and somewhat narrowed below in male, little over one-sixth clypeal width on middle; cheeks nearly one-sixth eye-length, no GNO; postalar wall, tympanic ridge and pit, lateral postscutellar plates, prosternum and propleura bare; 1 PS, PI and ST; no A, PRSA, PH, IPAL nor HPL; 1 extremely small PTL; 5R long-petiolate two-thirds length of M3 before wingtip, stalk three-fourths M3 and bent upward somewhat; R5 bare, R6 opposite R1 tip and near middle of 3M; M3 straight, at right angle to M2 and one and one-half times its length from cubitus; squamæ small, narrow, arcuately rounded behind, short, not projecting outside, inner corner arcuate; tarsi somewhat elongate; male abdomen narrow, well widened on intermediate segments, over twice length of thorax and of 6 visible segments above in male, basal segment a third length of first segment, 1 MM on first and second segments and MR on third and anal segments, first hypopygial segment of male as long as wide and tip bent under, second nearly as long as first, sternites covered.

Prolophosia petiolata sp. nov.—1 male, Caffraria (Wahlberg)

Length, 8 mm. Blackish; head silvery-white, front and occiput thinly silvery, frontalia black; antennæ brownish, base of third joint paler, arista

pale yellowish; thorax thinly silvery, sternopleura and coxæ silvery-white; abdomen thinly silvery on narrow bases of last three segments, legs brownish to blackish; wings nearly clear on a wide central area, the narrow costa and broad tip smoky, inner border less deeply smoky; squamæ white.—Male holotype, Stockholm.

Zambesopsis gen. nov.—Genotype, *Zambesa claripalpis* Vill.—Formosa

Runs out with *Zambesa* Walk. Head nearly a third wider than high and its profile subtriangular, vertex in front view little depressed between eyes; frontal profile nearly flat, well sloped and as long as facial; clypeus well sunk throughout, lower border of head much shorter than head-height, V strong and decussate, first antennal joint erect and somewhat elongate; arista bare, longer than antennæ, thickened one-fourth way in male and less in female; vertex-width in both sexes over one-fourth head-width and front widening to a third head-width at base antennæ, face uniform width and little over a third head-width, IVRS decussate; 2 PFRO in both sexes, in normal position and removed from row of FRS; frontalia uniform width, no postocellars, PVRS present and tips decussate or convergent, prosternum and propleura bare, no IPAL nor PTL, wings reaching to tip of abdomen, 5R narrowly to well open three times length of R6 before wingtip; R6 distinctly beyond S2 tip, approximated to base of R5 and far inside middle of 3M; squamæ long, somewhat widened and well rounded behind, not as wide as long, inner corner rounded; male claws much shorter than last tarsal joint; abdomen elongate, much narrowed on base in both sexes, male third segment little or not shortened ventrally and anal segment shorter than third dorsally; sternites narrowly exposed, tip of fourth triangularly exposed, no median processes on fifth in male and its lobes moderately wide, uniform width from base to tip and latter not pointed. Otherwise as in *Zambesa* Walk.—Male holotype, Berlin—Dahlem.

Formicocyptera gen. nov.—Genotype, *Ocyptera atrata* Fab.—Guinea

Runs out with *Clinogaster* Wulp. Frontal profile flat, a little sloped and as long as facial; clypeus flush and two and one-half times as long as wide, no facial carina but a swelling on median line above; epistoma distinctly narrowed from clypeus, as wide as parafacialia, cut short and gently warped; V well differentiated but weak, barely long enough to meet; vibrissal equal to antennal axis, latter and lower border of head both four-fifths as long as head-height, proboscis little over head-height, no palpi, antennæ closely approximated at base, second joint elongate, third in male scarcely over twice length of second, arista bare and thickened one-fourth way, eyes bare and reaching V level, male vertex-width nearly one-fourth head-width and face in middle half head-width, FRS stopping at base antennæ, IVRS straight, no OVRS nor FRO in male, OCS proclinate, parafacialia bare and two-thirds as wide as clypeus, cheeks over a third eye-length and posterior part facing nearly downward; tympanic ridge, lateral postscutellar plates,

squamopleura, prosternum and propleura bare; 3 PS, 2 ST, 1 PI, 1 PRSA, no A, PTL only short hairs, 3 HPL; 5R petiolate nearly M3 before wingtip, stalk longer than R6 and turned upward; R5 bristled at base, R6 nearly opposite R1 tip, M1 and M3 sinuate and latter its length from cubitulus; squamæ elongate, roundly and arcuately widened behind, projecting inside and not outside; male claws stout, pubescent and a little longer than last tarsal joint; male abdomen elongate, widened on middle, much constricted on the short basal segment, first segment evenly widening and thickening posteriorly, second nearly uniform width, third slightly narrowing posteriorly, first to third nearly equal length, anal half length of third, 1 erect MM on first two and MR on last two segments; second and third sternites covered and fourth exposed, fifth covered by fourth and tergite of latter.—Male holotype, Copenhagen.

EUTHERINI

Preuthera gen. nov.—Genotype, *Euthera peringueyi* Bezz.—Congo

Runs out with *Euthera* Loew. Facial carina prominent and straight in profile, epistoma in clypeal plane, palpi short and clavate, first antennal joint erect and moderately long, second elongate, third in female two and one-half times second; arista as long as third antennal joint, bare and thickened only on base; female front a third head-width, FRS stopping at base antennæ and decussate, 2 PFRO in female, parafacialia hairy on upper part; scutellum triangular, flattened, obtuse behind; 2 PRA, 3 PRS, APS only fine hairs; 5R petiolate, stalk much shorter than M1; latter nearly straight, M3 straight and a little nearer to cubitulus, latter slightly rounded, no MD on intermediate segments, sternites covered and female hypopygium simple. Otherwise as in *Euthera* Loew.—Female holotype, Milan.

CATHAROSIINI

Xanthopetia gen. nov.—Genotype, *Tachina fascipennis* Wied.—Nubia

Runs out with *Catharosia* Rdi. Head a little wider than high, frontal profile faintly arcuate and half again as long as facial, clypeus nearly flush and little longer than wide; epistoma cut short, full width of clypeus and widening below, distinctly warped subnasutely on edge; V barely differentiated from the 3 bristles below them, haustellum little longer than wide, labella moderate size, palpi filiform and little longer than antennæ, second antennal joint extremely short, third nearly as long as second in male, arista micro-pubescent and somewhat thickened a third way, male vertex-width equal to that of ocellar triangle and front widening to over a third head-width at base antennæ, FRS stopping at latter, IVRS straight, no OVRS nor FRO in male, frontalia linelike in male and parafrontalia contiguous throughout, OCS proclinate, row of 4 to 7 FCO hairs reaching from opposite base antennæ to V level, cheeks nearly one-sixth eye-length; lateral postscutellar plates, prosternum and propleural bare; 3 PS, 1 ST, no PTL; 5R symmetric, narrow and long petiolate over length of R6 before wingtip,

stalk one and one-half times length of M3 and in line of R5; latter bristled at base, R6 far outside R1 tip, M3 nearer to cubitulus and half its length from latter, which is arcuate and half wingwidth from hind margin; squamæ widely rounded behind and inner corner arcuate, tarsi extremely delicate, abdomen long-ovate and of 5 visible segments above in female, weak MR on first segment and strong MR on second to anal segments, second to anal in both sexes and first hypopygial in female all deeply impressed on base dorsally, sternites covered.—Male holotype, Berlin (Univ. Mus.); female allotype (head lacking), male paratype, Vienna.

GYMNOPEZINI

Eugymnopeza gen. nov.—Genotype, *E. braueri* nom. nov.—Europe

Runs out with *Micra* Zett. Head a third wider than high, frontal profile faintly arcuate and longer than facial, occipital profile much bulged on lower half, clypeus flush and a third longer than wide, facial depression including facialia triangular; epistoma full width of clypeus, wide, short and scarcely warped; facialia flattened into clypeal plane and practically fused with clypeus, V very short and not longer than bristles below them, vibrissal nearly equal to antennal axis, haustellum and rostrum very short, labella rather large, palpi slender and as long as third antennal joint, base antennæ near upper level of eyes, first antennal joint flush, second a little elongate, third little over second in male and half again as long as second in female, arista bare and thin, eyes bare and nearly (female) or quite (male) reaching V level, male vertex-width equal to width of ocellar triangle and that of female two-fifths head-width, front widening to over a third in male and over a half head-width in female at base antennæ, FRS stopping at latter, IVRS convergent, OVRS present, 4 short divaricate PFRO in female and none in male, no OCS, frontalia linelike throughout in male and narrowed nearly to line on middle in female, parafacialia thickly setose and lower half nearly in clypeal plane, cheeks nearly a third eye-length in male and two-fifths same in female; lateral postscutellar plates, prosternum and propleura bare; precutum little over half length of postscutum; no PRA, PH nor PST; 4 PS, 1 ST, 1 PRSA, short IPAL; 5R symmetric, narrow, well open in wingtip; R5 micro-bristled at base and very little curved toward M2, R6 outside R1 tip, M3 straight and its length from R6; squamæ small, narrow, little widened in female but somewhat more widened inward in male; middle and hind tarsi of female elongate, male abdomen ovate, four segments of equal length and no MM on any segments; female anal segment tubular, as long as both intermediate segments together, bent under abdomen; female theca straight and awllike; second and third sternites exposed and ventral membrane widely exposed.

Eugymnopeza braueri nom. nov. for *Gymnopeza denudata* BB. (nec Zett.)

—1 male and 1 female, Europe

Length of male, 4 mm; female $4\frac{1}{2}$ mm. Female: Head a little silvery; basal antennal joints, palpi, femora and whole thorax yellowish; three brown

thoracic vittæ extending the whole length of mesoscutum but more or less confluent posteriorly, postscutum with a similar vitta outside these on each side; frontalia and scutellum more rufous, abdomen metallic greenish-brown, tibiæ and tarsi dusky; wings yellowish on costa, the rest nearly clear; squamæ smoky. Male: Like the female except thorax and abdomen wholly blackish, basal antennal joints and palpi fulvous, humeri and posterior corners of postscutum testaceous.—Female holotype, male allotype, Vienna.

Note—The description of *Freræa gagatea* RD more nearly agrees with *E. braueri* than with any other known form in the Gymnopezini; but the contiguous eyes, absence of front and dilated hind tarsi in male, larger size and large squamæ preclude its reference here. It agrees with *E. braueri* in the V vestigial and not differentiated, 5R well open and hind legs elongate; in all of which it differs from *Gymnopeza albipennis* Zett, as well as in the much greater size and the limpid-clear hyaline wings of the male.

LEUCOSTOMATINI

Apostrophusia gen. nov.—Genotype, *Apostrophus anthophilus* Loew.—
High Alps

Runs out with *Ancistrophora* Mik. Head a third wider and somewhat longer than high, frontal profile nearly flat and only faintly sloped, clypeus flush and little longer than wide; epistoma full width and two-thirds length of clypeus, nasutely warped nearly into horizontal plane; facialia flattened to clypeal plane, V not differentiated and not long enough to meet, vibrissal axis longer than antennal and latter equal to head-height, haustellum three-fifths and rostrum half head-height, labella small, palpi filiform and as long as third antennal joint, antennæ not separated at base and latter near upper level of eyes, first antennal joint erect and moderately long; arista bare, not as long as antennæ, thickened bulblike less than halfway, the short base slender, rest suddenly thin; eyes bare and reaching oral margin level, male vertex-width over one-fourth and front widening to over a third head-width at base antennæ, face half head-width on middle, FRS stopping at base antennæ, IVRS straight, male frontalia widened posteriorly and twice width of one parafrontal on middle, OCS proclinate and strongly divaricate, para-facialia bare and nearly a third clypeal width, cheeks a third eye-length, no GNO; postalar wall, tympanic ridge and pit, lateral postscutellar plates, squamopleura, prosternum and propleura bare; 3 PS, 2 St; no PST, IPAL nor PTL; 3 HPL, 5R incomplete, M1 absent, R5 bristled at base and terminating over length of R6 before wingtip, R6 far outside middle of 3M and faintly outside R1 tip, M2 tip a third wing-width from hind margin, M3 straight and its length from M2 tip; squamæ very small, rounded behind, as wide as long, nearly circular excluding base, inner corner arcuate; male

abdomen subelliptic, slightly wider on basal half, a little narrower than thorax and nearly half again as long as latter, first and third segments equal length, second nearly two-thirds length of third, anal segment shorter than second, 1 MM and weak MR on first, thickly set MR on intermediate segments, very weak MR on anal segment, latter very short and bent downward to simulate base of hypopygium, first hypopygial segment bent below tip of abdomen, sternites and ventral membrane widely exposed, male hypopygium large.—Male(?) holotype, Berlin (Univ. Mus.)(?).

DEXIIDÆ

URODEXIINI

Pseudominthodes gen. nov.—Genotype, *P. scutellaris* sp. nov.—South Africa

Runs out with *Medinodexia* TT. Head only one-sixth wider than high and its profile subquadrangular, frontal profile flat and nearly as long as facial, clypeus well sunk and nearly two and one-half times as long as wide, epistoma short and in clypeal plane, vibrissal axis little under antennal and latter nearly two-thirds head-height, proboscis short and palpi slender, antennæ approximated at base and latter well above eye-middle, first antennal joint nearly flush and second short, arista micro-pubescent, eyes nearly bare and very oblique, vertex-width one-fifth head-width in male and one-fourth in female, front in both nearly uniform width, face nearly uniform width in female but widening below in male, FRS stopping at base antennæ, IVRS straight, 1 PFRO in female and none in male, parafacialia bare and a third clypeal width or so, cheeks one-fourth eye-length or so; postalar wall, tympanic ridge and pit, lateral postscutellar plates, prosternum and propleura bare; 2 heavy black thoracic vittæ, 3 PS, IPAL differentiated but short, 1 moderate PTL, strong costal spine, 5R narrowly open in wingtip, R1 and C1 bare, R5 bristled at base, R6 opposite R1 tip, M3 nearly midway, no stump at cubitus; squamæ small-ovate, narrow, not as wide as long, rounded behind; tarsi somewhat elongate, female front tarsi normal; abdomen short, ovoconic in male, narrow-ovate in female, 1 MM on first and second segments and MR on third and anal, 1 MD on intermediate segments and DR on anal, MR and DR on first hypopygial segment, sternites narrowly exposed; male hypopygium large, anal forceps slender, fifth sternite with large lobes.

Pseudominthodes scutellaris sp. nov.—1 male and 1 female, Caffraria (Wahlberg)

Length, $5\frac{1}{2}$ to 6 mm. Pale fulvous-yellow; head blackish, silvery-white pollinose, frontalia and first antennal joint brownish, second joint and palpi fulvous, third joint blackish, cheeks showing yellowish through pollen; mesoscutum and scutellum brownish-fulvous, thinly silvery, two wide vittæ of ground-color, abdomen with broad blackish median vitta, bases of last three segments thinly silvery in male, anal segment blackish; base of male

hypopygium, anal forceps and lobes of fifth sternite brownish; legs yellowish, tarsi blackish, wings nearly clear, squamæ watery-whitish.—Male holotype, female allotype, Stockholm.

Megistodexia gen. nov.—Genotype, *M. diaristata* sp. nov.—West Africa

Runs out with *Zosteromyia* BB. Head somewhat wider than high, frontal profile gently arcuate and two-thirds again as long as facial, clypeus considerably sunk, epistoma short and gently warped, facialia bare, vibrissal a little shorter than antennal axis and latter three-fifths head-height, proboscis short and palpi stout-cylindric, base antennæ below eye-middle; second antennal joint short, swollen and bearing 1 long curved bristle the length of arista; latter thickened only on base and short-plumose to tip, eyes bare and reaching rather below V level, male vertex as wide as ocellar triangle and front widening to one-sixth head-width at base antennæ, face on middle nearly a third head-width, 2 close-set FRS below base antennæ, no OVRs nor FRO in male, OCS proclinate and parallel, parafacialia narrow and bare, cheeks one-eighth eye-length, prosternum and propleura bare, 3 PS and ST, 1 strong PRA, no PA, 1 PRSA, IPAL scarcely developed, 1 moderate PTL, male wings long and nearly uniform width, 5R open over length of R6 before wingtip, R1 bare, R5 bristled at base, R6 nearly opposite R1 tip; squamæ narrow and elongate, arcuately rounded behind; legs and tarsi elongate; male abdomen not caudate, nearly twice as long as thorax, laterally compressed, in profile well narrowed on base and widening to third segment which is uniform width while anal segment narrows to tip, ventral profile nearly straight and dorsal convex, 1 MM on first two segments and 2 MM on third, MR on anal and 1 MD on last three segments; sternites covered except tip of fourth, fifth cleft.

Megistodexia diaristata sp. nov.—1 male, Ülleburg, Benito District, Spanish Guinea, West Africa (Tessmann)

Length, 12 mm. Blackish; head thinly silvery, frontalia dark brown, second antennal joint yellowish-brown, palpi brownish-yellow; thorax very thinly silvery, abdomen more distinctly silvery-white on narrow bases of intermediate segments, pleura and coxæ silvery, basal-half more or less of femora yellowish, rest of legs blackish; wings smoky-blackish, yellowish from costal spine to third basal cell, yellowish-hyaline in 3M and the elongation of first basal cell as well as on inner border; squamæ pale watery.—Male holotype, Berlin (Univ. Mus.).

Zosteromyiopsis gen. nov.—Genotype, *Myobia cingulata* Meq.—East Australia

Runs out with *Eophyllophila* TT. Head a little wider than high, frontal profile strongly sloped and one-fourth longer than facial, clypeus nearly flush, epistoma rather short and in clypeal plane, facialia bare, vibrissal axis three-fourths of antennal and latter three-fourths of head-height, pro-

boscis short, palpi elongate and cylindric, arista very short-plumose to tip; eyes nearly bare, very oblique and reaching nearly to V level; male vertex-width one-fifth head-width and front widening a little anteriorly, face below a third head-width, 1 to 2 FRS below base antennæ, IVRS pilelike in male and not decussate, 2 to 3 weak long hairlike proclinate OCS, parafacialia narrow and bare, cheeks one-sixth eye-length; postalar wall, tympanic ridge, prosternum and propleura bare; 3 PRA, PA, PS and PI; 2 ST, 1 moderate PTL, 2 LS and no APS, strong costal spine, 5R narrowly open, R6-length before wingtip, squamæ rounded and a little widened behind, male tarsi somewhat elongate and claws long, male abdomen not caudate, 1 MM on first segment and MR on last three, 1 MD on second and DR on last two segments, sternites covered.—Male holotype, Paris.

Tachinodexia gen. nov.—Genotype, *Tachina flavipennis* Wied.—East Indies

Runs out with *Eucalodexia* TT. Frontal profile arcuate and one-fourth longer than facial, clypeus depressed, epistoma short and distinctly warped, facialia bare, haustellum short and labella large, palpi slender and as long as third antennal joint, vibrissal axis a little shorter than antennal and latter three-fourths head-height, second antennal joint short, arista short-plumose to tip, eyes bare and nearly reaching V level, male vertex-width one-ninth head-width and front nearly a third head-width at base antennæ, FRS 1 below latter, IVRS decussate at tips, OCS proclinate micro-hairs, parafacialia narrow and bare, cheeks nearly one-fourth eye-length, prosternum and propleura bare, 3 PS, 2 ST, 1 strong PRA, 1 PRSA, IPAL weak, no PTL, costal spine short, 5R narrowly open twice R6 before wingtip, R5 bristled a third way to R6, strong stump at cubitulus, squamæ nearly uniform width and rounded behind, legs long and tarsi all longer than tibiæ; male front tarsi laterally compressed, much widened dorso-ventrally, thickly setose and half again as long as front tibiæ; male abdomen elongate, not caudate, constricted on front half and laterally compressed on hind half, 1 MM on first segment, MR and 1 MD on last three segments, sternites covered.—Male holotype (arista lacking), Copenhagen. (A second male in Copenhagen bears label "ex Ind: or: *Dexia flavipennis* Wd." but is the species described by Wiedemann as *Tachina flavipennis*. The male holotype of *Dexia flavipennis* Wied. is in Frankfurt-am-Main and came from Brazil.)

Zosteromyia braueri nom. nov. for *Myobia cingulata* BB (nec. Meq.)—1 male, Tasmania and 1 female, Cape York, Queensland

Length of male, 6 mm; female, 5 mm. Differs from Macquart's species as follows: Frontal profile arcuate and two-thirds longer than facial, vibrissal axis nearly as long as antennal and latter two-thirds head-height, eyes thinly short-hairy and reaching below V level, male vertex-width one-seventh head-width and front widened strongly anteriorly, cheeks one-tenth

eye-length, fourth tarsal joint greatly shortened and its sole elongated distally, front metatarsi exceeding following joints and others equalling them, first two segments with 2 MM in male and 1 MM in female, intermediate segments with 2 MD in male and 1 MD in female, MR on third segment, MR and 1 MD in male on anal segment but no macrochaetæ in female.—Male holotype, female allotype, Vienna.

SOPHIINI

Tipulidomima gen. nov.—Genotype, *T. tessmanni* sp. nov.—West Africa

Runs out with *Eucordyligaster* TT. Head not as wide as high, thoracic profile heavy and hump-like, abdominal profile slender-bottleshaped and widest on posterior half, frontal profile arcuate and nearly twice length of facial, clypeus gently sunk, epistoma slightly elongate and well warped, facialia bare, V strong and decussate, vibrissal axis as long as antennal and latter little over half head-length, haustellum short and stout, labella very large, palpi filiform and very short, antennæ approximated at base and latter below eye-middle, second antennal joint moderately short, male third joint nearly twice second, arista thickened only on base and scatteringly short-pubescent to tip, eyes bare and reaching below oral margin level, male vertex as wide as ocellar triangle and front widening to one-seventh head-width at base antennæ, face on middle little over one-fourth head-width, FRS decussate and stopping at base antennæ, IVRS decussate, no OCS, parafacialia narrow and bare, cheeks one-tenth eye-length, prosternum bristled, propleural bare, lateral postscutellar plates setose, 3 PS but wide space between front one and that next behind, 1 ST, 1 PRSA, no A nor IPAL, 1 short PTL, HPL a row of 9 to 12 long hairs and a second row of some short hairs, male wings very long and narrow, 5R open R6 before wingtip, R1 bare, R5 bare above but bristled at base below; squamæ elongate, half again as long as wide, somewhat widened on middle, arched over halteres, narrowed and arcuate behind; legs and tarsi elongate and very slender, filiform, hind femora $10\frac{1}{2}$ mm long and hind tibiae 11 mm, male claws extremely elongate; male abdomen nearly twice as long as thorax, strongly long-petiolate on base, laterally compressed, first segment constricted and cylindric, second gradually enlarging posteriorly, third uniform thickness, anal segment decreasing toward tip, 3 MM on first, 2 MM on second, 1 MM on third and anal, 1 separated MD on second but all other segments lacking MD, sternites covered; male hypopygium of moderate size and with anal exposure, anal forceps short, slender and divaricate with blunt tips.

Tipulidomima tessmanni sp. nov.—1 male, Ülleburg, Benito District, Spanish Guinea (Tessmann)

Length, 11 mm. Head thinly silvery-whitish, antennæ light yellow, arista dark, thorax brownish to blackish and very thinly silvery, abdomen yellow on first two segments, the last two and hypopygium blackish; legs blackish,

front and middle femora yellowish, hind femora brownish-yellow, wings pale yellowish, stigma and terminal part of costa faintly blackish, squamæ glassy yellowish-smoky.—Male holotype, Berlin (Univ. Mus.).

DOLESCHALLINI

Doleschalopsis gen. nov.—Genotype, *Doleschalla makilingensis* TT.—Luzon Island.

Runs out with *Doleschalla* Walk. Head not as wide as high; frontal profile flat, strongly sloped, more than a third longer than facial and well projected anteriorly; facial profile concave and receding, oral as long as frontal and rounded upward anteriorly and posteriorly; clypeus flush, uniform width and twice as long as wide; epistoma full width, a third as long as wide and strongly warped; V differentiated but not meeting, vibrissal axis nearly five-sixths length of antennal and latter over three-fourths head-height, haustellum nearly two-fifths head-height and labella large, palpi rather stout and subcylindric, base antennæ well above eye-middle, first joint flush but projecting forward from lunula, second short, arista short and very long-plumose to tip, eyes bare and very strongly oblique, male vertex-width little over one-seventh head-width and front widening to a third same at base antennæ, face on middle nearly three-fourths head-width, FRS closely hugging frontalia and stopping even with same anteriorly, IVRS not decussate, parafacialia bare and three-fourths clypeal width on middle, cheeks two-fifths eye-length, prosternum and propleura bare, 3 PS, 2 ST, no PRA nor IPAL, very long PTL, male wings long and narrow, no costal spine, 5R well open nearly in wingtip, strong stump at cubitulus in line with M2, squamæ well rounded behind and not large, legs very long and subfiliform, tarsi very elongate, male front metatarsi as long as front tibiae; male abdomen cylindric and over twice as long as thorax, faintly widened on tip as seen from above and thinner on base in profile, 1 strong MM on first three segments, MR and 1 MD on anal segment, sternites covered.—Male holotype, Lima.

Macrosophia gen. nov.—Genotype, *M. papua* sp. nov.—New Guinea

Runs out with *Doleschalopsis* TT. Body narrow and quite uniform width from head to base of anal segment, frontal profile well over facial in length, clypeus somewhat depressed, epistoma short and little warped but narrowed to little over a third width of clypeus, facialia bare and bowed, V apparently not well differentiated (scars), haustellum short and stout, labella large, palpi stout-clavate and bowed, second antennal joint moderately short and with 1 long thin bristle, arista long-plumose to tip, eyes bare and reaching short of V level, female vertex-width two-sevenths head-width and front widening to over a third same at base antennæ, FRS stopping at latter and hugging frontalia, no FRO in female, no OCS, ocellar triangle with very narrow polished prolongation reaching nearly halfway to lunula, ocelli closely approximated, parafacialia bare and narrowed below, cheeks perhaps

half eye-length (head imperfectly developed), prosternum and propleura bare, 2 PS, 1 ST, 1 PRSA, 1 PSA; no PRA, PRI, PH nor IPAL; 1 moderately strong PTL, HPL a patch of long pale to black hairs, 5R rather narrowly open R6 before wingtip, R1 and R5 bare, short stump at cubitus; squamæ well widened behind, nearly as wide as long, widely and arcuately rounded on outer-posterior border; legs very long and very slender throughout, front coxæ elongate but not front femora nor front tibiæ, other femora and tibiæ elongate, tarsi all very elongate and all metatarsi nearly as long as following joints together; female abdomen two and one-half times length of thorax, 6 visible segments from above not including tip of second hypopygial segment, basal segment nearly half length of first segment, intermediate and anal segments equal length and nearly as long as first, first hypopygial segment nearly a third length of anal on median line, anal segment narrowing posteriorly to two-thirds basal width at tip, first hypopygial narrowing rapidly to a rounded point, 1 MM on first to third segments, strong MR and 1 MD on anal, MR of short weak hairs on first hypopygial segment, sternites practically covered; female hypopygium small, like *Cordyligaster*, terminating in a pair of hairy papillæ whose bases are overlapped by the rounded tip of theca.

Macrosophia papua sp. nov.—1 female, April River Mouth, New Guinea (Bürgers)

Length, 16 mm. Parafrontalia pale golden, parafacialia dusky with silvery-white crossband at base antennæ; frontalia, third antennal joint and palpi blackish, second antennal joint rufous, cheeks with blackish band from lower border of eye, thorax and scutellum blackish, a wide vertical silvery fascia on mesopleura and sternopleura, sides and hind margin of mesoscutum widely pale golden pollinose, median vitta of same pollen on prescutum, infrascutellum with same pollen; abdomen blackish, first to third segments polished rufotestaceous with faint dusky median vitta and deep black narrow hind margins, basal segment and front border of first segment black, anal segment and hypopygial tergites polished brown, legs brown, tarsi black, wings and squamæ nearly clear.—Female holotype, Berlin (Univ. Mus.).

ZELIINI

Philotrichostylum gen. nov.—Genotype, *Trichostylum fasciatum* TT.—Mindanao Island

Runs out with *Ophirodextia* TT. Head a little wider than high, frontal profile arcuately bulged and over twice length of facial, latter concave, oral profile little longer than facial and nearly straight, clypeus scarcely depressed and nearly twice as long as wide, no facial carina, epistoma short and well warped, facialia bare, V decussate, vibrissal axis equal to antennal and latter two-thirds head-height, proboscis little over half head-height and palpi slender-clavate, antennæ well separated at base and latter far below eye-middle, first joint flush with frontalia but projected above lunula, sec-

ond short, arista thinly long-plumose three-fourths way or so, eyes bare and strongly oblique, male vertex-width little over one-fifth head-width and front widening rapidly forward, face on middle three-fifths head-width, close-set FRS hugging frontalia and stopping at base antennæ, IVRS straight, no OVS nor FRO in male, strong proclinate OCS, parafacialia bare and as wide as clypeus, cheeks half eye-length, no GNO, prosternum bare, propleura thickly bristled, several long bristles on middle of postalar wall below upper edge, 4 PS, 2 ST, no IPAL, 1 strong PTL as long as ST, male wings broad and narrowing to tip, 5R open considerably before wingtip, stump at cubitus in line with M2, squamæ wide and inner corner angular, legs moderately elongate, hind tibiæ thickly short-ciliate and without longer bristle, male claws short, abdomen ovate, no MM on first two segments and MR on last two, sternites covered.—Male holotype, Lima.

CALIRRHOIDÆ

DEXILLINI

Prodexilla gen. nov.—Genotype, *P. petiolata* sp. nov.—South Africa

Runs out with *Trichoprosopus* Mcq. Head nearly as wide as high, frontal profile flat and three-fourths length of facial, faciooral profile arcuate, clypeus sunk cuplike and nearly twice as long as wide, no facial carina; epistoma longer than clypeus, not half as wide as same and receding downward; facialia bare, parallel, fused with clypeus and fully half as wide as latter; V long, decussate but little longer than bristles next them, set at middle of facial profile; vibrissal axis nearly as long as antennal and latter three-fifths head-height, haustellum little over one-fourth head-height and labella large, palpi slender and scarcely thickened at tip, antennæ approximated at base and latter above eye-middle, first joint erect and very short, second short, eyes bare and reaching V level, female vertex over a third head-width and front nearly half same at base antennæ, face on middle three-fifths head-width, FRS 1 below base antennæ, IVRS straight, 2 PFRO and no RFRO in female, OCS proclinate and weak, parafacialia setose above cheek-grooves and half again as wide as clypeus, cheeks four-fifths eye-length and cheek-grooves occupying nearly whole cheek area, no GNO, prosternum and propleura bare, few hairs at upper edge of postalar wall, 4 PS, 2 ST, IPAL differentiated, 1 moderate PTL; 5R long-petiolate half M3 before wingtip, stalk half M3 and nearly in line with R5; R1 bare, R5 bristled nearly halfway to R6, stump at cubitus two-thirds length of M3, M1 faintly and M3 heavily sinuate, latter much nearer to cubitus which is nearly half wingwidth from hind margin; squamæ rather large, well widened behind and a little longer than wide; tarsi elongate, female abdomen ovate and subpointed at tip, no MM on first segment, 1 MM on second, MR on third with MM set forward, MR and DR on anal segment, sternites covered.

Prodexilla petiolata sp. nov.—1 female, Cape of Good Hope (Wahlberg)

Length, 7 mm. Blackish, thinly silvery; parafrontalia slightly golden, rest of head pollen silvery, frontalia brown, second antennal joint fulvous-yellow, palpi yellow; thorax silvery, 4 blackish vittæ, inner pair narrow and outer pair considerably wider, abdomen blackish and thinly silvery, first segment and hind half of others varying to brownish, legs brownish, tibiæ paler, wings nearly clear, squamæ whitish.—Female holotype, Stockholm.

CALIRRHINI

Africodexia gen. nov.—Genotype, *Dexia lugens* Wied.—Cape Good Hope

Runs out with *Platyrhinodexia* TT. Head scarcely wider than high, frontal profile arcuate and half again as long as facial, clypeus slightly depressed on sides; facial carina high, wide, longitudinally furrowed on crest and wider than facialia; epistoma a third length of clypeus, nearly full width of latter and nearly in vertical plane; facialia bristled less than halfway, V differentiated and tips decussate, vibrissal area thickly bristled and bristles two-thirds length of V, vibrissal axis equal to antennal and latter five-sixths head-height, palpi filiform and longer than antennæ, latter well separated at base and set on lower third of eye, second joint short and male third joint over twice second, arista moderately long-plumose on base and plumosity shortening evenly to tip, eyes bare and reaching far short of V level, male vertex-width one-eighth head-width and front over a third same at base antennæ, FRS stopping at latter and hugging frontalia, IVRS decussate at tips, no OVRs nor FRO in male, OCS proclinate and parallel, parafacialia wider than clypeus and faintly microsetose, cheeks two-thirds eye-length and cheek-grooves very large, prosternum bare, propleura short-pilose, 3 PS, 3 to 4 ST, no IPAL, PTL moderate size, male wings narrow, 5R closed over R6 before wingtip; squamæ large, long and well widened behind; legs long in male, middle and hind femora and tibiæ and all tarsi elongate, male claws long, male abdomen ovoconic and truncate, 1 weak MM on first segment, 1 strong MM on second, MR on third and 1 MD on intermediate segments, anal segment sparsely covered, macrochætæ erect and not spinelike, sternites covered and fifth well cleft in male.—Male holotype, male paratype, Copenhagen (Westermann Coll.).

Macropodexia gen. nov.—Genotype, *Dexia longipes* Meq.—Tasmania

Runs out with *Rhynchiodexia* Big. Whole body whitish-pilose including thorax and scutellum, pile longer on sides and below; frontal profile gently arcuate and a third longer than facial, clypeus scarcely depressed on sides and antennal pits nearly flush; facial carina heavy, wide, longitudinally furrowed on crest, over twice as wide as facialia; epistoma full width, half as long as wide and nearly in vertical plane; V strong and decussate, vibrissal axis equal to antennal and latter three-fourths head-height, haustellum stout and scarcely three-fourths head-height, labella large, palpi slender and little over half length of third antennal joint, antennæ well separated at

base and latter on lowest fourth of eye, arista long-plumose on base and plumosity decreasing evenly to tip, eyes bare and reaching far short of V level, vertex-width one-eighth head-width in male and one-fourth same in female, FRS stopping at base antennæ and hugging frontalia, IVRS not decussate, 2 PFRO in female and none in male, OCS proclinate and strong, parafacialia bare and as wide as clypeus, cheeks half eye-length in male and two-thirds same in female, prosternum bare, propleura short-pilose, 3 PS, 2 ST, 1 strong PRA, IPAL differentiated, PTL only pile with at times a black bristle, HPL only a thick row of yellow pile, male wings long and narrow, 5R open over R6 before wingtip; squamæ large, widened and squared behind, as wide as long and inner corner subangular; front coxæ shaggy-pilose, front legs short and hind legs extremely long, hind femora 8 mm., hind tibiæ 8 mm., hind tarsi $9\frac{1}{2}$ mm., middle legs greatly elongate, middle and hind tarsi very long and slender with the metatarsi as long as following joints together, hind tibiæ curved and somewhat thickened on distal half, male claws not longer than last tarsal joint; male abdomen ovoconic, that of female ovate and wider, macrochætæ not spinelike, 1 MM on first two segments and MR on last two, 1 MD on intermediate segments in male but none in female, sternites partially exposed.—Male holotype, Copenhagen (Westermann Coll.—labelled “*Dexia longipes* Macq., Diemens Land: Bigot”).

LARVÆVORIDÆ

MICROTROPESINI

Amphitropesa gen. nov.—Genotype, *A. elegans* sp. nov.—Australia

Runs out with *Zita* Curr. Frontal profile strongly arcuate and nearly twice facial in length, latter deeply concave, clypeus moderately depressed and no facial carina; epistoma wide and nearly full width of clypeus, two-thirds as long as latter and strongly warped; vibrissal axis little over antennal and latter nearly three-fourths head-height, haustellum three-fifths head-height and labella large; palpi stout and longer than antennæ, much swollen at tip in female and finely hairy; antennæ gently separated at base, second joint short and third over three times second, arista as long as antennæ and long-pubescent to tip, eyes bare and reaching well short of V level, female vertex-width nearly a third head-width and front half same at base antennæ; FRS stopping at latter and hugging frontalia, 11 in all and mostly yellow; IVRS short and decussate, 1 PFRO in female and 1 small proclinate bristle behind it occupying place of RFRO, OCS strong and proclinate-divaricate, parafacialia bare and nearly as wide as clypeus, cheeks three-fifths eye-length, prosternum and propleura bare, 4 PS and hind one yellow, 3 yellow ST, no PRA nor IPAL, 2 PA and hind one yellow, 3 PI and hind one yellow, 4 PSA and hind 2 yellow, 3 yellow PAL, 5R open over R6 before wingtip, R5 with 2 yellow bristles at base, short stump at cubitus, squamæ not very large and nearly as wide as long, abdomen stout-ovate, no MM on first and anal segments, 1 weak MM on intermediate segments and interrupted weak MR on third, sternites narrowly exposed.

Amphitropesa elegans sp. nov.—1 female, New South Wales

Length, $10\frac{1}{2}$ mm. Head deep rufous-yellow including frontalia, antennæ and palpi; parafacialia golden pollinose, the color extending on parafrontalia in oblique view; pleura yellow, thinly silvery pollinose, mesoscutum dull silvery, two black spots before and four behind transverse suture, scutellum yellow, first abdominal segment black above, second black with front corners silvery, third silvery with three black spots, anal segment wholly silvery; venter silvery but widely black on median line, legs yellow, wings yellow on oblique costobasal half and the rest smoky, squamæ yellow.—Female holotype, London (Brit. Mus.).

NEMORÆINI

Prohypotachina gen. nov.—Genotype, *P. rutilioides* sp. nov.—Indo-China

Runs out with *Nemoræa* RD and *Trophomyia* Ald. Head very small and narrow, as wide as high; frontal profile strongly sloped and half again as long as facial, clypeus well sunk on each side and over twice as long as wide, strong facial carina present; epistoma short, full width of clypeus and in plane of crest of facial carina; facialia over half as wide as clypeus, obliquely flattened and their plane bowed, ciliate nearly halfway with not over 6 strong bristles; vibrissal axis three-fourths length of antennal and latter two-thirds head-height, haustellum stout and nearly as long as antennæ, labella huge and nearly as long as haustellum; palpi as long as antennæ and heavy, flattened and bristled, wide from base to the suddenly pointed tip and somewhat bowed upward distally; antennæ approximated at base and latter well below eye-middle, second joint elongate and third two and one-half times second; arista over half again as long as antennæ, very thin and very short-plumose halfway; eyes thickly pilose and reaching far short of V level, male vertex-width one-eighth head-width and front a third same at base antennæ, 2 to 3 FRS below latter and 14 in all, IVRS decussate at tips, no PFRO in male and no OCS, parafacialia bare and as wide as facialia inverted, cheeks nearly half eye-length, 4 strong GNO, prosternum and propleura bare, lateral postscutellar plates with a few bristlets; 3 PS, ST, PRA, PA, PRS and PI; IPAL scarcely differentiated, PTL probably strong; male wings long, narrow and narrowing to rounded point at tip; 5R open twice R6 before wingtip, short strong stump at cubitulus; squamæ bare, large, heavily widened and square behind, rather wider than long; hind and middle femora somewhat elongate, hind tibiæ short-ciliate and with 4 longer bristles, tarsi somewhat elongate and male claws extremely long; male abdomen broad and flattened, nearly as wide as long, no MM on first segment, 4 strong MM on second and file of 4 strong MD, MR and file of 3 MD on third with 2 more MD outside file, anal segment irregularly bristled, first hypopygial segment with bunch of 8 bristles each side, sternites exposed in triangles and bristled; male hypopygium large and set ventrally at tip of anal segment, anal forceps azygos, triangular and sharp-pointed with tip bent suddenly hooklike, lobes of genitosternite triangular, tenth sternite narrow and curved.

Prohypotachina rutilioides sp. nov.—1 male, Manson Mts., Tonking, Indo-China, 2000 to 3000 ft. (Fruhstorfer)

Length, 17 mm. Head dull brassy pollinose, parafrontalia more silvery, antennæ and frontalia blackish, palpi and labella fulvous; thorax black, pale gold pollinose, four heavy black vittæ, scutellum testaceous with black base and gold pollinose; abdomen rufofulvous, blackish on base and with blackish median vitta which spreads on hind borders of the segments, legs black, pulvilli yellowish, wings broadly yellow on basal half of costa and smoky on the veins of remaining parts, squamæ whitish but somewhat tinged with smoky-yellowish.—Male holotype, Vienna.

LARVÆVORINI

Xantholarvævora gen. nov.—Genotype, *X. formosa* sp. nov.—Africa (?)

Runs out with Larvævoropsis TT. Haustellum two-thirds head-height, palpi stout and little thickened at tip in female, third antennal joint little over three-fourths length of second in female, first aristal joint short and second nearly two-fifths length of third, eyes bare, female vertex-width two-fifths head-width, 2 FRS below base antennæ, IVRS not decussate, 2 PFRO in female, frontalia of female widened posteriorly and well over width of one parafrontal on middle, OCS strong and proclinate, parafacialia setose and nearly as wide as clypeus above, cheeks half eye-length, 4 PS, 3 ST and PI, 3 strong LS and HLS decussate, no APS, 5R open M3 before wing-tip, R5 bristled at base, M3 over a third its length from cubitulus, last section of C1 nearly half length of preceding section; abdomen ovoglobular in female, largely yellow; anal segment elongate and narrowed behind, emarginate on front border; no MM on first segment, 1 MM on second, interrupted MR on third, weak MR and DR of spines on anal segment.

Xantholarvævora formosa sp. nov.—2 females, “Chr 71” which I take to mean Khartum (Loew Coll.)

These specimens are labelled “Echinomyia formosa Lw.” and “Coll. H. Loew: Type: Chr 71” The name does not appear to have been published and is introduced here as new. The species is about the size and color of *Fabriciella ferox* except that the abdomen is yellow with three large black spots on median line.—Female holotype, female paratype, Berlin (Univ. Mus.).

DEJEANIINI

Melanojeania gen. nov.—Genotype, *Dejeania pertristis* Vill.—Central Africa

Runs out with Dejeania RD. This form differs from Dejeania mainly in the third antennal joint being fully as long as second, the parafacialia below little wider than facialia, and the general coloration deep black. It represents a distinct group from Dejeania, which latter has the third antennal joint much shorter than second, the parafacialia below fully twice as

wide as facialia and the coloration pallid.—Male holotype, female allotype, London (Brit. Mus.).

CUPHOCERATINI

Everestiomyia gen. nov.—Genotype, *E. antennalis* sp. nov.—High Himalayas

Runs out with *Punamyia* TT. Facial profile flat, faintly sloped and little longer than facial; clypeus flush and wide; epistoma full width, two-thirds length of clypeus, enormously produced in horizontal plane and nasute; V long but only a little longer than bristles below, vibrissal axis to tip of epistoma equal to head-height and much over antennal, latter four-fifths of head-height, haustellum as long as head-height and labella small, palpi slender-cylindric and as long as antennæ, second antennal joint short; third joint in male extremely widened to truncate tip, triangular, as wide on tip as length of lower side, latter three times length of second joint; arista as long as antennæ, bare, thickened nearly to tip, both basal joints very long and nearly equal, the two together nearly as long as third; eyes densely long-pilose, male vertex-width a third head-width, 4 FRS below base antennæ, no PFRO in male, OCS exactly divaricate and only faintly proclinate, parafacialia black-pilose on outer two-thirds, prosternum and propleura bare, 1 long PRA, no PA, 3 PS and ST, 5R open half M3 before wingtip, R1 bare, R5 bristled at base, stump at cubitulus, squamæ widened and rounded behind but not large, male claws elongate, no MM on first segment, 1 MM on second and MR on last two, 1 MD on intermediate segments, irregular DR and many bristles on anal, all macrochaetæ slender and whole body rather long black-pilose, sternites exposed and male hypopygium large.

Everestiomyia antennalis sp. nov.—1 male, Rongbuk Glacier, Mt. Everest, 16500 ft. (Longstaff)

Length, $10\frac{1}{2}$ mm. Black; antennæ deep black with brownish bloom, palpi black, parafrontalia and parafacialia thinly silvery pollinose, thorax very thinly silvery to tawny and largely shining, four equal narrow black vittæ, scutellum testaceous on tip and rest shining black, abdomen shining black, wings clear, squamæ white.—Male holotype, London (Brit. Mus.).

Innshanotroxis gen. nov.—Genotype, *I. engeli* sp. nov.—Mongolia

Runs out with *Epidolichostoma* TT. Head only a little wider than high and its profile subquadrangular, frontal profile in horizontal plane and three-fourths the length of facial; clypeus flush on median line but gently depressed on sides, narrowing above and below, scarcely half again as long as wide; epistoma well narrowed from clypeus, two-thirds width of latter, scarcely one-fourth as long as wide and warped at an angle of 45 degrees; V strong and decussate, twice length of bristles below; vibrissal axis equal to antennal and latter three-fifths head-height; haustellum stout and two-fifths head-height, corneous; labella moderately large; palpi stout-cylindric, longer than third antennal joint, bowed and bristled; antennæ approximated at base and latter on upper level of eyes, first joint erect and elongate, sec-

ond very long; third in male little longer than second, strongly widened to truncate tip, the width of tip half length of joint; arista thickened three-fourths way to sharp porrect tip, bare, basal joints both elongate; eyes bare and reaching far short of V level, male vertex-width two-fifths head-width and front nearly three-fifths same at base antennæ, face in middle two-thirds head-width; FRS doubled anteriorly in male, 3 to 5 below, 1 to 2 opposite and 6 behind base antennæ; IVRS straight, 2 strong PFRO in male, OCS as strong as PFRO and proclinate-divaricate, 8 strong close-set FCO in irregular row, parafacialia setose besides and nearly half as wide as clypeus, cheeks as wide as eye-length, cheek-grooves large and subtriangular, no GNO but only long bristly hairs of occipital area, prosternum and propleura bare, 4 PS and PRS, 2 strong PA and 4 PRA, 3 ST and PI, 2 PRSA and the front one far inside, no PH nor IPAL, long strong PTL, scutellum with thin suberect spines on disk, 6 long equal LS marginal and submarginal, shorter but long gently divaricate APS, male wings scarcely reaching tip of abdomen, costal spine very small, 5R open two-thirds M3 before wingtip, R1 bare, R5 bristled at base, cubitus two-fifths wingwidth from hind margin and without stump or wrinkle; squamæ nearly as wide as long, arcuate on outer-posterior border, long-pilose on outer margin and narrowly on upper surface, mid tibiæ with many long spines and hind tibiæ with less number, tarsi moderately long and somewhat slender, male claws nearly as long as last tarsal joint; male abdomen almost twice as long as wide, subsquared-elliptic from above but rounded at base and tip, no MM on first segment, lateral three-eighths of second segment bare of spines but median fourth of same and all of dorsum of last two segments and hypopygium covered with short slender erect spines of even length, body not pilose, sternites triangularly exposed and bristled.

Innshanotroxis engeli sp. nov.—1 male, Inn Shan, Mongolia (Engel)

Length, 18 mm.; width of head, little over 4 mm.; thorax, 6 mm.; abdomen, $6\frac{1}{2}$ mm. by 10 mm. long. Wholly black, not pollinose; head and second antennal joint brownish, third joint black, palpi pale brownish-fulvous, tibiæ and tarsi pale brownish-yellow, wings faintly smoky but very broad costobasal area deep fulvous-yellow especially on veins, squamæ same deep yellow.—Male holotype, Munich (Bav. States Mus.).

LINNÆMYINI

Hecatoepalpus gen. nov.—Genotype, *Micropalpus prohecate* Spsr.—Lake Nyassa

Runs out with Linnæmya RD and Bonnetia RD. Differs from latter as follows: Haustellum three-fourths head-height and palpi nipplelike, second antennal joint elongate in male and third twice length of second, male vertex-width one-fourth head-width, no PFRO in male, parafacialia little over half clypeal width and bare on more than lower half, cheeks nearly half eye-length, 2 strong PRSA in line, 4 LS, 5R open little over half M3

before wingtip, R5 bristled at base, cubitus with stump a third length of M3, latter twice length of R6 from cubitus, which last is less than two-fifths wingwidth from hind margin.—Male holotype, Stockholm.

Anæudora gen. nov.—Genotype, *A. aureocephala* sp. nov.—Formosa

Runs out with *Bonellimyia* TT. Head considerably wider than high, frontal profile somewhat arcuate and little longer than facial, clypeus flush, epistoma one-fifth as long as wide and gently warped, facialia flattened to clypeal plane and fused, V strong, vibrissal axis a little shorter than antennal, haustellum nearly two-fifths head-height, palpi nearly as long as antennæ and swollen knoblike at tip, first antennal joint erect and short, third in female shorter than the very elongate second joint, second arisal joint long and first very short, female vertex-width a third head-width and front widening to half same anteriorly, 2 FRS below base antennæ, IVRS straight, 2 strong PFRO in female, strong proclinate and nearly parallel OCS, parafacialia two-thirds as wide as clypeus and yellow-pilose, cheeks three-fifths eye-length, 4 strong GNO, prosternum and lateral postscutellar plates bare, propleura with long fine pile, 3 PS and ST, IPAL a strong bristle, strong curved PTL longer than ST, 3 LS and strong decussate APS, 5R open far before wingtip, R5 bristled nearly one-fourth way to R6, cubitus with strong stump longer than R6 and nearly in line of M2, R6 little outside tip of S2, last section of C1 short, no MM on first segment, 1 MM on second, MR of 10 on third, MR and DR on anal segment with weak bristles on very hind edge, sternites widely triangularly exposed.

Anæudora aureocephala sp. nov.—3 females, Sokutsu and Taihorinsho, Formosa (Sauter)

Length, 13 to 14 mm. Head golden including occiput, frontalia testaceo-fulvous to brownish, antennæ and palpi fulvous, arista and tip of third antennal joint blackish, humeri and pleura thinly silvery, mesoscutum and scutellum shining bluish-black with trace of silvery pollen, four faint black vittæ, abdomen black, intermediate segments thinly silvery on basal half, anal segment wholly rufofulvous with faintly silvery base, legs black, wings yellow from base to stigma, black from stigma to tip of R5 and along veins, squamæ whitish.—Female holotype, Berlin-Dahlem; female paratype, Lima.

GERMARIINI

Athryciopsis gen. nov.—Genotype, *Tachina ruficornis* Zett.—Sweden

Runs out with *Klugia* RD. Frontal profile flat, sloped and nearly as long as facial; clypeus slightly depressed; epistoma short, full width and in clypeal plane; vibrissal axis nearly three-fourths length of antennal and latter three-fifths head-height, palpi clavate, third antennal joint twice second in female and longer in male; arista bare, as long as third antennal joint, thickened nearly to tip, basal joints short; eyes bare and reaching short of V level, vertex-width two-fifths head-width in female and nearly that in

male, 2 FRS below base antennæ, IVRS straight, 2 to 3 PFRO in both sexes, OCS proclinate-divaricate, 2 strong infraclinate FCO and parafacialia sparsely setose on upper half or so, cheeks a third eye-length, 1 to 2 strong GNO, prosternum and propleura bare; 3 PS, ST, PA, PRA, PRS, PI; 1 very long curved PTL, 5R narrowly open to closed the length of M3 before wingtip, R1 bare, R5 bristled half to two-thirds way to tip, R6 opposite R1 tip, very short stump at cubitus and latter over half wingwidth from hind margin, M3 midway, last section of C1 half to two-thirds length of preceding; squamæ widened and rounded behind, nearly as wide as long and projecting on sides; hind tarsi normal, male claws nearly equal last tarsal joint, no MM on first segment, 1 MM and 2 MD on second, MR and 1 to 2 MD on third, MR and 2 MD on anal, sternites covered.—Male holotype, female allotype, Lund—(*Athrycia erythroceræ* RD, holotype lost, was a very distinct form from this).

SALMACIIDÆ

PHOROCERATINI

Paraphryno gen. nov.—Genotype, *Tachina vetula* Mg.—Germany

Runs out with *Ophirosturmia* TT. Head profile cuneiform; frontal profile flat, considerably sloped and a little shorter than facial; clypeus sunk, epistoma distinctly elongate and little warped, facialia bare, V well above lower border of head, vibrissal axis two-thirds antennal and latter little over three-fifths head-height, arista very long and thickened scarcely halfway, eyes thickly long-pilose, male vertex-width nearly a third head-width, no PFRO in male, parafacialia practically bare, cheeks nearly three-fifths eye-length, prosternum bristled, propleura and lateral postscutellar plates bare, 4 PS and 3 ST, IPAL well differentiated, PTL moderately strong and curved, 5R open, R5 bristled at base, last section of C1 very short, hind tibiae not ciliate, male claws extremely long, abdomen ovate, 1 strong MM on first two segments and 1 MD on intermediate segments, MR on last two segments and anal segment scatteringly covered with bristles, second to fourth sternites covered in male.—Male holotype (?).

EXORISTINI

Lydellina villeneuvei nom. nov. for *Lydella caffra* Vill. (nec. Mcq.)—1 male and 1 female, Cape Town and Durban

Length, 13 mm. This is quite distinct from *Lydella caffra* Mcq. in the ciliate facialia.—Female holotype, male allotype, Cape Town (So. Afr. Mus.).

PHORINIINI

Wiedemanniomyia gen. nov.—Genotype, *Tachina metallica* Wied.—East Indies

Runs out with *Stomatotachina* TT. Head much wider than high and its profile subquadrangular; frontal profile flat, sloped and nearly as long as facial; clypeus well sunk; epistoma full width of clypeus, somewhat elongate

and strongly warped subnasutely between V; facialia bare, vibrissal axis a little shorter than antennal and latter three-fifths head-height, haustellum nearly half head-height, palpi bowed and slightly thickened at tip in male, third antennal joint 4 times second and narrow; arista bare, thickened halfway and second joint elongate; eyes thickly pilose and reaching V level, male vertex-width one-fourth head-width and front nearly a third same at base antennæ, 4 separated FRS below latter reaching halfway to V level, IVRS straight, no PFRO in male, OCS strong and proclinate, parafacialia bare and as wide as facialia inverted, cheeks one-fifth eye-length, prosternum pilose, propleura bare, 4 PS; 3 ST, PI, PRA and PA; IPAL strong, 5R very narrowly open nearly M3 before wingtip, R1 bare, R5 bristled at base, last section of C1 over a third preceding, cubitus two-fifths wing-width from hind margin, squamæ large and well widened behind, hind tibiæ not ciliate, male claws long; male abdomen ovate, third segment nearly twice as long as second and over three times as long as anal, its dorsum thickly clothed with very fine black hair; no MM on first segment, 1 MM on second and MR on last two segments, second to fourth sternites covered except extreme tips.—Male holotype, Copenhagen—(*Tachina nigriventris* Wied, male holotype, Copenhagen, labelled "Ind: or," is a synonym).

ELODIINI

Molliopsis gen. nov.—Genotype, *Mollia malayana* TT.—Sumatra

Runs out with *Oedemamedina* TT. Head a little wider than high, frontal profile sloped and a little longer than facial, clypeus well depressed and less than twice as long as wide; epistoma short, wide and in clypeal plane; facialia ciliate over halfway, vibrissal axis two-thirds antennal and latter two-thirds head-height, haustellum short and labella large, palpi slender, third antennal joint three and one-half times second in male, arista micro-pubescent and thickened a third way, eyes bare and reaching V level, male vertex-width one-seventh head-width and face half same below, 2 FRS below base antennæ, 2 PFRO and 4 RFRO in male, OCS proclinate, parafacialia bare and very narrow, cheeks one-sixth eye-length, no GNO, 3 PS, 2 ST, 3 PA, 2 PRA, 5R narrowly open to closed just before wingtip, R1 bare, R5 with 1 bristle at base, squamæ well rounded behind, middle and especially hind femora elongate in male, claws of male as long as last tarsal joint and pubescent; male abdomen long-ovoconic and over half again as long as thorax, 1 MM on first two segments, 1 MD and MA on second; MR, DR and anterior row on third and anal segments.—Male holotype, Amsterdam (N. Artis Mag.).

CARCELIINI

Sericophoromyiops gen. nov.—Genotype, *Tachina dasyops* Wied.—Cape Good Hope

Runs out with *Sericophoromyia* Aus. Long shaggy yellow pile on pteropleura and mesopleura, short pile on base of venter, mesoscutum and dor-

sum of abdomen lacking pile; head profile flattened-semicircular, frontal profile strongly arcuate and a third longer than facial, clypeus very shallow and nearly three times as long as wide; epistoma full width, a third as long as wide and distinctly warped; facialia bare, male third antennal joint little over twice second and truncate at tip, arista longer than antennæ and thin, eyes thickly pilose and reaching below oral margin level, male vertex-width nearly one-sixth head-width and front uniform width, face below nearly a third head-width, 4 FRS below base antennæ, IVRS straight, parafacialia brownish-pilose on inner half, cheeks one-eighth eye-length, prosternum short-pilose, IPAL strong, third and fourth segments of male venter with pair of confluent spots of short thick hair, no MM on first two segments or rarely a very short pair on second, MR of 12 on third, anal segment thickly set with macrochètæ and bristles, second sternite narrowly exposed but third and fourth scarcely at all, fifth not showing lobes in male. Otherwise as in *Sericophoromyia*.—Male holotype, Copenhagen (Westermann Coll.)—(The genotype of *Sericophoromyia* is *S. amplipilosa* Curr. It has the whole body thickly pilose, facialia strongly ciliate, frontal profile flat and little longer than facial, cheeks nearly one-fourth eye-length, and MM on first two segments.)

Thecocarcelia gen. nov.—Genotype, *Argyrophylax pelmatoprocta* BB.—Austria

Runs out with *Gymnocarcelia* TT. Head nearly half again as wide as high; frontal profile nearly flat, strongly sloped and as long as facial; clypeus considerably sunk, epistoma short and warped, facialia bare, vibrissal axis three-fifths length of antennal and latter little over half head-height, haustellum short and stout, labella large, palpi elongate and stout, third antennal joint of female four and one-half times the short second; arista long, thin and bare; eyes bare and reaching V level, female vertex-width nearly a third head-width and front almost uniform width, 2 FRS below base antennæ, 2 PFRO in female, OCS proclinate, parafacialia narrow and bare, cheeks little over one-tenth eye-length, no GNO, 4 PS and ST, 5R open well before wingtip, hind tibiæ pectinate and 1 longer bristle in female, 1 MM on first two and MR on last two segments, anal segment irregularly covered with bristles; female theca 2 mm. long and one-half mm. wide, flattened dorsoventrally, uniform width, consisting of two plates: upper plate flat, practically all in one plane, rounded on tip; lower plate gently curved both transversely and longitudinally, lateral edges curved upward, base and tip curved downward, semicircularly emarginate on tip and latter slightly projecting beyond upper plate, the two plates enclosing the ovipositor.—Female holotype, male allotype, Vienna.

STURMIINI

Chrysopygia gen. nov.—Genotype, *C. auricaudata* sp. nov.—Java

Runs out with *Podosturmia* TT. Head-width well over head-height, frontal profile strongly sloped and little longer than facial, clypeus well

depressed and nearly three times as long as wide; epistoma full width, nearly a third as long as wide and gently warped; facialia not ciliate, vibrissal axis three-fourths antennal and latter nearly two-thirds head-height, haustellum little over one-fourth head-height, labella very large, palpi stout and scarcely thickened at tip in male, third antennal joint little over three times second and narrow; arista half again as long as antennæ, thin and micro-pubescent; eyes bare and nearly reaching V level, male vertex-width one-fourth head-width and front a third same at base antennæ, 2 FRS below latter and 8 behind, 2 strong PFRO in male, no OCS, parafacialia over half as wide as clypeus and setose next below FRS, cheeks nearly a third eye-length, no GNO, prosternum thickly bristled, propleura bare, 4 strong PS, 2 ST, 3 PRA and PA, strong IPAL, 1 moderate PTL and bristle-bunch, 4 strong LS, weak short straight APS, 5R open nearly twice R6 before wing-tip; squamæ large and much widened behind, nearly as wide as long; hind tibiæ thickly ciliate and no longer bristle, male claws short, small pilose spots on venter of third and fourth segments in the male, no MM on first two and strong short MR on last two segments, sternites covered, lobes of fifth small.

Chrysopygia auricaudata sp. nov.—1 male, Java (Fruhstorfer)

Length, 11½ mm. Head very pale gold, occipital orbits and posterior cheeks silvery-white, frontalia blackish, antennæ brown, palpi brownish-fulvous, thorax thinly silvery and showing four black vittæ with inner pair narrow, abdomen blackish and slightly reddish on sides, second segment silvery-white pollinose with sinuate limits posteriorly to the pollen which reaches near hind margin of segment on middle third, last two segments with similar pollen pattern but the pollen deep gold, legs blackish, wings nearly clear but veins lightly tinged with smoky, squamæ whitish.—Male holotype, Vienna.

BELVOSIINI

Gonanamastax gen. nov.—Genotype, *Blepharipeza gonæformis* Mcq.—Tasmania

Runs out with *Anamastax* BB. Frontal profile a little longer than facial, epistoma strongly warped, facialia oblique and ciliate halfway, V strong, vibrissal axis nearly as long as antennal and latter three-fourths head-height, proboscis as long as head-height, palpi long and slender, antennæ set little above eye-middle, third joint of female narrow and 4 times second; arista bare and thickened to tip, basal joints short; eyes thickly long-pilose, female vertex-width not a third head-width and front very wide anteriorly, 3 to 4 irregular rows of FRS, parafacialia setose, cheeks nearly a third eye-length, 5R narrowly open in wingtip, no stump at cubitulus, last section of Cl short.—Female holotype (abdomen lacking), Paris.

Anamastax australis nom. nov. for *Blepharipeza goniaeformis* BB. (nec. Meq.)—Several males, Queensland

Length, $12\frac{1}{2}$ mm. Blackish; head silvery, frontalia brownish-fulvous, palpi yellowish; second antennal joint, second abdominal segment except hind margin and narrow base of third segment obscurely rufous; thorax thinly silvery pollinose with four narrow blackish vittæ, scutellum in large part obscurely testaceofulvous and thinly silvery, intermediate abdominal segments and venter thinly silvery pollinose as well as narrow base of anal segment, legs blackish, wings clear, squamæ white.—Male holotype, Vienna; male paratype, Lima.

LYDELLINI

Gyrovaga gen. nov.—Genotype, *Tachina vicina* Ztt.—Sweden

Runs out with *Tachinosalia* Vill. Head a third wider than high, frontal profile well sloped and little over facial, clypeus faintly depressed, epistoma strongly warped, facialia bare, eyes pilose, vertex-width two-sevenths head-width in male and three-eighths same in female, 3 FRS below base antennæ, 2 PFRO in female and none in male, no OCS, parafacialia bare, prosternum bristled, propleura and lateral postseutellar plates bare, 4 PS, 3 PRA and PA, IPAL developed, no PTL, 2 long and 2 short LS, short decussate APS, 5R open three-fourths M3 before wingtip, squamæ widened behind and not projected outside, hind tibiæ pectinate and 1 longer bristle, male claws very long, 1 weak MM on first segment and 1 strong MM on second, MR on last two segments and 2 irregular DR on anal segment, sternites covered.—Female holotype, male allotype, Lund.

Chlorolydella gen. nov.—Genotype, *C. caffrariae* sp. nov.—South Africa

Runs out with *Anoxycampta* Big. Head one-fourth wider than high; frontal profile flat, well sloped and nearly as long as facial; clypeus gently sunk and little over half again as long as wide; epistoma short, full width and warped; facialia strongly ciliate to FRS, V very long and strong, vibrissal axis three-fourths length of antennal and latter three-fourths head-height, haustellum less than half head-height, labella large, palpi long and clavate, antennæ set high above eye-middle and only faintly separated at base, first joint erect and elongate, second somewhat elongate, third in male three and one-half times second and uniformly widened; arista bare, thickened nearly to sharp tip and basal joints short; eyes thickly long-pilose and not reaching V level, male vertex-width a third head-width, front and face gently widening from vertex, 4 FRS below base antennæ, IVRS straight, no PFRO in male, OCS strong and proclinate-divaricate, parafacialia bare and nearly a third clypeal width on middle, cheeks a third eye-length, bunch of strong GNO, prosternum bristled; propleura, postalar wall, tympanic ridge and lateral postseutellar plates bare; 4 PS and 3 ST, 3 PRA and PA, IPAL well developed, 1 moderate PTL, 3 heavy long and equal LS, shorter suberect decussate APS, long costal spine, 5R open three-fourths M3 before

wingtip, R5 bristled two-fifths way to R6, cubitulus over two-fifths wing-width from hind margin; squamæ subtriangular, not very large, nearly as wide as long; hind tibiæ irregularly bristled, male claws long, 1 MM on first two and MR on last two segments, 1 strong MD on second and 2 or more on third, anal segment with 2 DR and irregular shorter bristles, second to fourth sternites covered and fifth with large lobes.

Chlorolydella caffrariæ sp. nov.—1 male, Caffraria (Wahlberg)

Length, 9 mm. Parafrontalia, mesoscutum and scutellum bright metallic green, parafacialia silvery, facial depression silvery from side; cheeks, occiput and pleura darker green with faint violet reflections; frontalia, antennæ and palpi blackish, second antennal joint faintly fulvous; abdomen violet, anal segment and middorsum of third dark green, sides of abdomen faintly thinly silvery in oblique view, legs brownish, tibiæ slightly paler, wings nearly clear, squamæ whitish.—Male holotype, Stockholm.

TRYPHERINI

Rhinomydes gen. nov.—Genotype, *R. emporomyioides* sp. nov.—Formosa

Runs out with *Myiopharus* BB. Head one-fourth wider than high; frontal profile arcuate, well sloped and one-fifth longer than facial; clypeus slightly depressed and nearly twice as long as wide; epistoma short, nearly full width and scarcely warped on rim; facialia ciliate halfway with 4 to 5 strong bristles, V decussate and set below median oral margin level, vibrissal axis two-thirds antennal and latter three-fourths head-height, haustellum little longer than labella, palpi clavate and rather short, antennæ set slightly below eye-middle, first joint erect but very short, second very elongate and third half again as long as second in female; arista micro-pubescent, thickened on base and basal joints short; eyes rather thinly pilose and not reaching V level, female vertex-width one-fourth head-width and front widening evenly to over a third same anteriorly, face nearly uniform width, 2 FRS below base antennæ, IVRS straight, 3 strong equal PFRO in female, OCS proclinate-divaricate, parafacialia bare, cheeks nearly a third eye-length, 2 GNO, prosternum scantily bristled, propleura and postalar wall bare; 3 PS, PI, PRA, PA and ST but middle one of last weak; IPAL well developed, 1 moderate PTL, 3 strong equal LS and small erect decussate APS, costal spine very strong and rather longer than R6, 5R neck-petiolate well before wingtip, squamæ moderately large and longer than wide, female midcoxae lacking etenidium, hind tibiæ peetinate and with 2 longer bristles, tarsi shortened, last joint of front tarsi in female widely flattened and over twice as long as wide, 1 MM on first two and MR on last two segments, 1 MD on intermediate segments and anal sparsely covered except anterior fourth, sternites covered.

Rhinomyodes emporomyioides sp. nov.—1 female, Kankau, Formosa (Sauter)

Length, 7 mm. Black, thinly silvery; palpi, antennæ and frontalia blackish or brown, cheek-grooves brown, rest of head thinly silvery, thorax same with

two wide shining black outer vittæ that are nearly confluent with the line-like inner pair, abdomen shining black, bases of intermediate segments thinly silvery for one-fourth their length, legs black, wings faintly smoky-yellowish, squamæ watery white.—Female holotype, Berlin-Dahlem.

Thelycarcelia gen. nov.—Genotype, *T. thrix* sp. nov.—Formosa

Runs out with *Cadurciella* Vill. Head very much wider than high; frontal profile gently arcuate, strongly sloped and as long as facial; latter faintly bulged and receding downward, clypeus well depressed and not twice as long as wide; epistoma full width, very short and scarcely warped on edge; facialia bare and fused with clypeus, V decussate and set below median oral margin level, haustellum swollen and very short, palpi clavate and tips bare; third antennal joint of male 7 times the short second, wide and nearly uniform width but the upper edge gently bulged; arista long, bare, thickened a third way and thin, basal joints short; eyes almost bare and reaching V level, male vertex-width nearly a third head-width and front faintly widening therefrom, face slightly narrowed from front on middle and below, 2 FRS below base antennæ, IVRS not decussate, 2 strong PFRO and RFRO in male, OCS strong and proclinate-divaricate, parafrontalia bare and strongly narrowed below in male, cheeks nearly one-seventh eye-length, no GNO, prosternum pilose, propleura and postalar wall bare, 4 PS and ST, 3 PRA and PA, 4 LS and decussate APS, 5R open, R1 bare, R5 bristled at base, hind tibiæ pectinate and 1 very long bristle, male claws short, 1 MM on first two and MR on last two segments, shorter DR on anal segment.

Thelycarcelia thrix sp. nov.—2 males, Kankau & Sokutsu, Formosa (Sauter)

Length, 7 mm. Head silvery-white pollinose, parafrontalia and mesoscutum with faint brassy tinge, frontalia and antennæ dark brown, palpi yellow, five black thoracic vittæ and the inner three narrow, scutellum testaceous except base, abdomen faintly fulvous on sides, last three segments pollinose except hind margins and a slight brassy tinge to pollen, legs dark brown, wings clear, squamæ sordid whitish.—Male holotype, Berlin-Dahlem; male paratype, Lima.

Formosodorcia gen. nov.—Genotype, *Sturmia dilabida* Vill.—Formosa

Runs out with *Cadurciella* Vill. Head half to three-fourths wider than high, frontal profile arcuate and one-fifth longer than facial, clypeus a little depressed; epistoma full width, short and but faintly warped; facialia bare, vibrissal axis four-fifths antennal and latter three-fifths head-height, haustellum little longer than labella and latter large, palpi stout-clavate, first antennal joint erect and short, third nearly three times the short second and wider in male, basal aristal joints short, eyes nearly bare, male vertex-width over one-fourth head-width and female a third same, face nearly uniform width in female but widening below in male, 2 FRS below base antennæ, IVRS straight, 2 PFRO in female but none in male, 2 RFRO in both sexes,

OCS strong and proclinate, parafacialia bare, cheeks one-sixth eye-length, no GNO, prosternum bristled, propleura and lateral postscutellar plates bare, 4 PS and ST, 3 PRA and PA, strong IPAL, 1 moderate PTL, 3 LS and suberect decussate APS, 5R open nearly half M3 before wingtip, R1 bare, R5 bristled at base, squamæ nearly as wide as long, male claws moderately long, 1 MM on first two and MR on last two segments, DR on anal, second to fourth sternites covered except extreme tips.—Female (?) holotype, Berlin-Dahlem.

Stylurodoria gen. nov.—Genotype, *S. stylata* sp. nov.—Formosa

Runs out with Sumatrodoria TT. Head little over one-fourth wider than high, frontal profile nearly flat and almost as long as facial, clypeus gently sunk and over twice as long as wide, epistoma one-fourth as long as wide and gently warped, facialia bare and nearly as wide as parafacialia, vibrissal axis a little shorter than antennal and latter two-thirds head-height, haustellum little longer than the large labella, palpi heavy-clavate and longer than third antennal joint, first antennal joint erect and short, third three and one-half times second in male and shorter in female; arista bare, thickened halfway, second joint twice as long as wide; eyes nearly bare and almost reaching V level, female vertex-width a third head-width and male a little less, female face nearly uniform width and male widening some below, 2 FRS below base antennæ, IVRS straight, 2 PFRO in female and none in male, 1 RFRO in both sexes, strong proclinate OCS, parafacialia bare and half clypeal width, cheeks nearly one-fourth eye-length, no GNO, prosternum bristled, propleura bare, 4 PS and ST, 3 PRA and PA, strong IPAL, 1 moderate PTL, 4 LS and shorter decussate APS, 5R open well before wingtip, R1 bare, R5 bristled at base, M3 nearer to cubitus, squamæ well widened, no ctenidium on female midcoxae, hind tibiae well ciliate and 1 longer bristle in both sexes, male claws long, abdomen ovate in male and ovoconic in female, 1 short MM on first two and short MR on last two segments, anal segment thickly bristled on hind half, sternites covered in female and very narrowly exposed in male, female with slender piercer and last three segments of venter with short heavy spines.

Stylurodoria stylata sp. nov.—22 males and 15 females, Kankau, Formosa (Sauter)

Length, 8 to 10 mm. Head silvery-white, frontalia and antennæ dark brown, palpi fulvous, thorax silvery with a distinct leaden hue, five nearly equal blackish vittæ but inner pair narrower before suture, scutellum testaceous and silvery pollinose; abdomen dark brown or blackish, faintly reddish on sides in male, irregular basal three-fifths of intermediate segments and basal half of anal silvery, legs black, wings clear, squamæ nearly white.—Female holotype, male allotype, Berlin-Dahlem; male and female paratypes, Lima.

Orientodoria gen. nov.—Genotype, *Tachina orientalis* Wied.—East Indies

Runs out with *Oxynops* TT. Frontal profile arcuate and little longer than facial, clypeus sunk and over twice as long as wide, epistoma short and rim faintly warped, facialia strongly ciliate and nearly half width of clypeus, vibrissal axis three-fifths antennal and latter three-fifths head-height, haustellum short and labella large, palpi stout-cylindric and not as long as third antennal joint, latter in female two and one-fourth times the somewhat elongate second joint; arista bare, thickened over halfway and tapered, basal joints short; eyes nearly bare, female vertex-width a third head-width, front and face nearly uniform width, 2 FRS below base antennæ, 2 PFRO and 1 RFRO in female, OCS proclinate-divaricate, parafacialia bare and little wider than facialia inverted, cheeks one-fourth eye-length, prosternum bare save 1 quite strong PST; propleura, postalar wall, tympanic ridge and lateral postscutellar plates bare; 4 PS; 3 ST, PI, PRA and PA; IPAL well developed, 1 strong PTL, costal spine strong, 5R narrowly open nearly length of M3 before wingtip, R1 bare, R5 bristled nearly halfway to R6 with 3 to 5 bristlets, M3 over its length from cubitulus and not far from midway, last section of C1 half length of preceding, squamæ widened behind and projecting somewhat outside, 1 weak MM on first and 1 strong MM on second segment, MR on last two segments, sternites covered.—Female holotype, Copenhagen.

Argyrophylacoides gen. nov.—Genotype, *Degeeria zetterstedtii* Krsch.—Central Africa

Runs out with *Cadureia* Vill. Head one-fourth wider than high, frontal profile arcuate and a third longer than facial, clypeus moderately sunk and over twice as long as wide, epistoma short and in clypeal plane, facialia bristled nearly halfway, vibrissal axis a little shorter than antennal and latter three-fifths head-height, haustellum short and labella large, palpi clavate, third antennal joint of male a little over twice second and narrow; arista a little longer than antennæ, thickened one-fifth way, short-pubescent nearly to tip, basal joints short; eyes base and reaching oral margin level, male vertex-width little over one-sixth head-width, 4 FRS below base antennæ, no PFRO in male but 2 strong RFRO, OCS strong and proclinate, parafacialia bare and nearly as wide as facialia inverted, cheeks nearly one-fourth eye-length, prosternum bristled, propleura and lateral postscutellar plates bare, 4 PS, 2 ST, 3 PRA and PA, strong IPAL, 1 moderate PTL, 5R narrowly open little over R6 before wingtip, R1 bare, R5 bristled at base, squamæ well widened and squared behind, male claws elongate, venter of third abdominal segment of male with pair of patches of very fine thickly-set short hair, no MM on first segment, 1 MM on second and MR on last two segments, bristly hairs on disk of third and irregular submarginal bristles on anal segment, second to fourth sternites covered, fifth cleft.—Female (?) holotype, Berlin (Univ. Mus.); male allotype (?), Copenhagen (Westermann Coll.), labelled “*T. zetterstedti* Westm. Guinea.”

PHRYNOINI

Chlorophryno gen. nov.—Genotype, *Gymnocheta glauca* Krsch.—West Tanganyika

Runs out with *Austrophryno* TT. Head a third wider than high, frontal profile somewhat sloped and a little shorter than facial, latter very receding, clypeus gently depressed and nearly three times as long as wide, epistoma short and warped, facialia strongly ciliate to FRS with 5 to 8 bristles, vibrissal axis little over three-fifths antennal and latter three-fourths head-height, haustellum a third head-height and labella very large, first antennal joint erect and long, third joint nearly six times second in male and nearly three times same in female; arista long, micro-pubescent, a little thickened halfway, crooked, basal joints short; eyes thickly long-pilose, vertex-width somewhat over a third head-width in both sexes, face and front nearly uniform width, 2 FRS below base antennæ, IVRS straight, 2 PFRO in female and none in male, 2 RFRO in both sexes, OCS long and proclinate-divaricate, parafacialia bare save a few setæ next lowest FRS and more numerous in male, cheeks rather over one-fourth eye-length, no GNO, prosternum bristled, propleura bare, 4 PS, 3 ST, 3 PRA and PA, IPAL scarcely developed, 1 moderate PTL, 5R open a third M3 before wingtip, squamæ nearly as wide as long, tarsi elongate, 1 MM on first two and MR on last two segments, 1 MD on intermediate segments, irregular DR on anal segment, sternites covered.—Female holotype, Berlin (Univ. Mus.).

FRONTININI

Eodolichocolon gen. nov.—Genotype, *Dolichocolon orientale* TT.—Sumatra

Runs out with *Cryptocladocera* Bezz. Head little wider than high, frontal profile flat and nearly two-thirds length of facial, clypeus deep and over three times as long as wide, epistoma short and moderately warped, facialia heavily ciliate with 4 to 6 huge infraclinate bristles, vibrissal axis much shorter than antennal and latter over half head-height, haustellum stout and short, labella very large, palpi clavate, first antennal joint erect and moderately long; third joint of male 6 to 7 times second, very large and uniform width with truncate tip; arista nearly as long as antennæ, bare, thickened over halfway, second joint half length of thickened part of third; eyes thinly short-hairy and straight, male vertex-width about one-fourth head-width, 4 FRS below base antennæ, IVRS not decussate, no PFRO in male, OCS strong and proclinate, parafacialia bare, cheeks nearly one-fourth eye-length, no GNO, prosternum strongly bristled, propleura bare, 4 PS; 3 ST, PI, PRA and PA; 2 moderately long PST, IPAL a strong bristle, 1 moderate PTL and bristles, 2 long LS, shorter strongly decussate APS, 5R open three-fifths M3 before wingtip; squamæ much widened behind, nearly as wide as long and projecting outside; hind tibiae ciliate and with 1 longer bristle in male, claws of male very short, abdomen ovate and deep, 1 MM on first two and MR on last two segments, discals on anal segment, sternites somewhat exposed.—Male holotype, Amsterdam (N. Artis. Mag.).

VORIINI

Neuroplagia gen. nov.—Genotype, *Plagia nudinerva* Vill.—Spain

Runs out with *Hyleorus* Ald. Differs from latter as follows: Frontal profile not longer than facial, third antennal joint of female less than twice length of second joint, arista as long as third antennal joint, eyes reaching a little short of V level, front and face over a third head-width in female, parafacialia not narrowed to a line below, 4 PS, 3 PRA and PRI, IPAL differentiated, HLS reaching base of anal segment, 5R very narrow and closed twice length of M3 before wingtip, R1 bare, R5 bristled to point halfway between base M1 and tip 5R, M1 in line with M3, latter little over half its length from both R6 and cubitulus, last section C1 nearly three-fifths wingwidth from hind margin of wing.—Female holotype, Rambouillet (Vill. Coll.).

ACTIINI

Malaiocrocota gen. nov.—Genotype, *Tochina molitor* Wied.—East Indies

Runs out with *Istoglossa* Rdi. Head little wider than high; frontal profile flat, well sloped and three-fifths length of facial; clypeus faintly depressed and two and one-half times as long as wide, epistoma short and scarcely warped but incrassate, facialia bare, vibrissal axis as long as antennal and latter scarcely over half head-height, haustellum setose and half head-height, palpi clavate, second antennal joint very short, third narrow in female and little over four times second; arista nearly as long as third antennal joint, bare, thickened to tapered tip, second joint elongate; eyes bare and nearly reaching V level, female vertex-width nearly half head-width and both front and face nearly uniform width, 2 FRS below base antennæ, 2 PFRO in female and 1 RFRO in line with PFRO, 2 pairs of divaricate OCS and front pair slightly proclinate, parafacialia bare and over half clypeal width, checks a third eye-length; prosternum, propleura, postalar wall, tympanic ridge and lateral postscutellar plates bare; 3 PS and ST, 2 PRA, 1 PRSA, no PIH, 1 moderate PTL; 5R petiolate half M1 before wingtip, stalk half M3 and in line with R5; R1 bare, R5 with 2 to 3 bristles which may extend halfway to R6, latter opposite S2 tip, last section C1 nearly half preceding, squamæ widened behind and projecting on outer side, no MM on first two and MR on last two segments.—Female holotype, Copenhagen.

Discochæta braueri nom. nov. for *Tachina muscaria* BB. (nec. Fall.)—

Several males, Mehadia, Hungary

Length, 5 mm. Second antennal joint, palpi and scutellum pale yellowish; head, thorax and narrow bases of last three segments silvery.—Male holotype, Vienna; male paratype, Lima.

STUDIES ON CHEMICAL CHANGES DURING THE LIFE CYCLE OF THE TENT CATERPILLAR (MALACOSOMA AMERICANA FAB.)

V. WEIGHT AND DATA¹

BY WILLEM RUDOLFS²

In former publications (1) curves and discussions have been presented on the results obtained in a study of the chemical changes taking place during the life cycle of the tent caterpillar. Measurements and weight of the growing larvæ, the original data, together with a brief general summary are the purpose of this paper.

MATERIAL

A collection of about one thousand egg masses of the tent caterpillar were kept in an insectary from which lots of from 50 to 75 egg masses were used for analyses. Another lot was kept in the laboratory and subjected for about $2\frac{1}{2}$ days to a constant temperature of 80° F. and constant atmospheric moisture content of 73.4 per cent. After the caterpillars were formed in the egg-shells they were removed by hand and some analyses made. The caterpillars upon hatching were analyzed in lots of from 50 to 1,000, depending upon the size. Pupæ and adults were analyzed in lots of about 50 individuals.

RESULTS

After the egg-masses had been in the insectary for about two months the weight of the egg-masses was apparently determined mainly by the moisture content of the larvæ. The relation is shown in table 1, where the results obtained from individual egg-masses are given.

¹ Journal Series paper of the N. J. Agricultural Experiment Station, New Brunswick, N. J. Dept. of Entomology.

² Chief, Dept. Sewage Research.

TABLE 1
WEIGHT OF EGG-MASSSES AND LARVÆ

	July	Aug.	Sept.	Nov.	Jan.
Number of eggs	330	360	355	320	370
Total weight one mass (gr.)	.0990	.1040	.1000	.0905	.1015
Weight of larvae (gr.) .....	.0545	.0565	.0530	.0434	.0555
Percentage weight of larvæ...	55.1	54.0	53.0	51.9	48.0
Percentage moisture larvæ.....	61.9	58.2	56.2	52.2	49.1

Atmospheric conditions affected the wet weight of the egg-masses also to some extent. The following most widely varying results between egg-masses taken from the insectary and those subjected to a constant conditioned air stream show this:

Moisture content of egg-masses from:

Insectary <i>per cent.</i>	Air stream <i>per cent.</i>
42.48	44.80
43.79	40.97
44.86	39.19

The results obtained on chemical analyses of the larvæ taken from the shells are given in table 2, while the results obtained

TABLE 2
ANALYSES OF LARVÆ TAKEN FROM EGGS

Date	Mois- ture	Soluble ash	Total nitrogen	Ether soluble
July	61.9	5.03	9.42	0.46
Aug.	58.2	4.40	.....	.....
Sept.	56.2	4.43	10.00	1.06
Oct.	54.1	4.40	10.45	0.95
Nov.	52.2	4.20	10.80	0.90
Dec.	50.8	3.80	11.55	0.90
Jan.	49.1	3.64	12.07	0.75
Feb.	44.4	.....	14.20	0.35

on the average weight and average length of the larvæ, and the chemical analyses of larvæ, pupæ and adults are shown in table 3. During the year monthly analyses were made on

TABLE 3
LENGTH, WEIGHT AND CHEMICAL CONSTITUENTS OF LARVAE, PUPAE AND ADULTS

Number	Date	Average weight	Average length	Moisture	Total ash	Total nitrogen	Ether soluble (fat)	Sulfates	Carbonates	Glycogen	Soluble ash	
		mgr.	mm.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	
9	4/1	0.3	2-2.5	39.4	6.67	15.10	0.66	0.24	5.22	2.79	5.46	Newly hatched
10	4/6	6.0	4-5	68.5	3.74	.....	1.74	0.26	5.90	2.92	3.52	Growing larvae
11	5/6	18.5	12-14	83.8	4.93	10.50	5.85	0.24	6.40	2.65	4.63	" "
12	5/9	52.0	18	84.3	6.67	9.90	7.88	0.27	7.60	2.03	7.90	" "
13	5/11	68.8	20	85.1	9.25	10.30	8.56	0.11	6.10	1.82	6.20	" "
14	5/15	197.3	28	84.0	7.54	9.00	9.42	0.12	5.90	1.30	6.00	" "
15	5/17	237.6	32	82.9	6.39	9.00	10.04	0.22	6.00	0.78	6.26	" "
16	5/18	313.5	34	85.4	7.73	9.20	11.04	0.39	7.00	0.48	7.37	" "
17	5/21	684.8	40-42	82.1	7.17	8.45	15.06	0.27	6.80	0.23	7.04	" "
18	5/27	642.0	42-46	79.3	8.13	10.55	18.71	0.02	7.00	0.15	7.03	Full grown, become flabby
19	5/29	463.0		72.1	3.18	9.36	24.05	0.02	2.50	0.74	2.54	Prepupal stage
20	5/31	357.0		71.0	3.81	8.26	28.82	0.01	3.75	0.45	3.76	Just pupated, color lemon
21	6/8	250.0		64.1	4.33	9.89	26.01	0.01	4.30	0.08	4.33	Ready to hatch, some in act
22	6/12	185.3		59.9	2.87	9.03	24.70	0.008	2.60	.....	2.62	Adult (26 males, 22 females)

NOTE.—Chemical analyses all on basis of dry weights of insects.

batches of egg-masses. The analytical results are given in table 4.

TABLE 4
ANALYSES OF EGG-MASSSES

Date	Mois- ture	Total ash	Soluble ash	Fats	Total nitrogen	Sul- fates	Carbo- nates
	<i>per cent.</i>	<i>per cent.</i>	<i>per cent.</i>	<i>per cent.</i>	<i>per cent.</i>	<i>per cent.</i>	<i>per cent.</i>
June 22.....	48.5	1.32	0.41	4.45	11.49	0.16	0.25
July 18.....	45.5	1.93	1.85	1.71	12.82	0.30	1.45
Aug. 11.....	40.8	2.30	2.11	1.48	12.82	0.36	1.75
Sept. 13.....	42.0	2.35	2.12	1.40	13.02	0.35	1.80
Oct. 30.....	46.2	2.49	2.14	1.32	13.32	0.35	1.82
Nov. 17.....	42.5	4.07	2.76	1.21	14.00	0.42	2.34
Dec. 15.....	43.0	3.75	2.80	1.12	13.10	0.42	2.20
Jan. 12.....	43.8	3.32	2.58	1.06	13.07	0.39	2.19
Feb. 18.....	44.8	3.90	2.90	0.56	14.29	0.49	2.41

One more or less complete analysis of the cover and egg-shell as compared with the egg-mass was made. The results are partially shown in table 5. The larvæ taken from these egg cases

TABLE 5
ANALYSES OF EGG-MASSSES, COVER AND EGG-SHELLS

	Egg-mass	Cover	Egg-shells*
Moisture, per cent.	42.50	8.30	15.70
Total ash, per cent.	4.04	2.46	0.74
Insoluble ash, per cent.	1.30	0.12	trace
Sulfates, per cent.	0.46	trace	trace
Carbonates, per cent.	trace	0.0	trace
Chlorides, p.p.m.	0.45	0.1	trace
Amino-nitrogen, per cent.		0.835	
Ammonia nitrogen, p.p.m.	13.4	35.4	
Albuminoid nitrogen, p.p.m.	669	1062	
Ether soluble (fat), per cent.	1.20	0.0	
Glycogen, per cent.	2.31	0.48	

* Traces of cover adhering to egg-shells.

contained 2.87 per cent. of glycogen. The egg-masses gave positive tests for urea, tryptophane, xanthoproteic reaction, reduced

sulfur reaction (cystine, cysteine), carbohydrates, sugars and phosphorus. They showed a negative test with Millon' reaction, Ehrlich's diazo reaction (histidine, tyrosine) and cholesterol. The covers were positive for urea, tryptophane, reduced sulfur, carbohydrates and phosphorus. All other tests showed negative.

DISCUSSION

The average weight of the larvæ increased rapidly during this part of the life cycle of the insects. With the gradual increase in weight the moisture content increased rapidly and remained fairly constant after the first two instars until they were full grown. The weight and moisture content decreased again during transformation. However, the decrease in weight was greater than the reduction in moisture content. The decrease in wet weight of the full grown larvæ to the adult amounted to 81 per cent., whereas the decrease in moisture content amounted to 50.7 per cent.

The percentage ether soluble material (fats) increased gradually during the first two instars, increased rapidly during the next three instars and increased at an accelerated rate during

TABLE 6
DRY WEIGHT, FATS AND NITROGEN CONTENTS PER INSECT

No.	Dry weight	Fats	Total nitrogen
	<i>mgr.</i>	<i>mgr.</i>	<i>mgr.</i>
9 .....	.18	.0012	.027
10	1.92	.0143	.....
11	3.0	.175	.32
12	9.4	.740	.93
13	10.2	.875	1.05
14	31.5	2.97	2.83
15	40.3	4.03	3.62
16	47.5	5.17	4.37
17	122.0	18.40	11.05
18	133.0	24.85	14.05
19	129.0	31.00	12.10
20	103.0	29.65	8.50
21	90.0	23.40	8.90
22	74.3	18.35	6.70

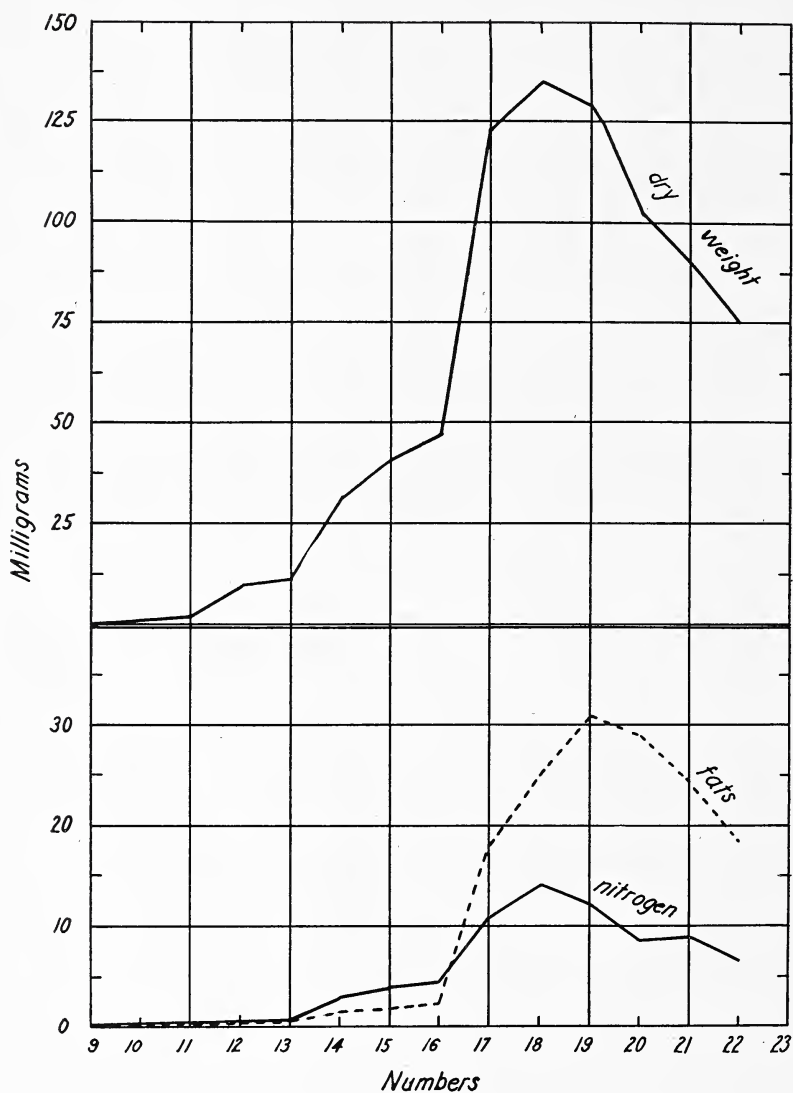


FIG. 1. Relation between dry weight per insect and weight of fats and nitrogen of larvæ, pupæ and adults.

the first part of metamorphosis, while the percentage decreased during the second part. However, the actual amount of ether soluble material per insect decreased somewhat during the first part of metamorphosis (table 6). The relation between the dry weight of the insects and the weight of fats and nitrogen is shown in figure 1. While the insects were losing some moisture just before pupation, fat production continued somewhat, but as soon as the transformation processes began the fat content decreased with the result that 41 per cent. of the fats were consumed between the prepupal stage and the full grown adult.

Total nitrogen per dry insect increased in the rapidly growing larvæ at a slightly faster rate than the fats. A considerable actual loss of nitrogen took place during pupation processes. While the fat content decreased 24 per cent. between the prepupal and ready to hatch stages, the nitrogen loss amounted to 38 per cent. It is also interesting to note that the total amounts of fats still increased from the full grown to prepupal stage, while the nitrogen decreased, indicating that the first transformation processes were made at the expense of nitrogen present.

Upon hatching the soluble ash content was higher than a few days later, probably due to waste products stored when the insects remained in the egg-cases. After the initial drop there was a persistent increase of soluble ash in the growing larvæ.

The percentage of glycogen in the growing larvæ decreased but the actual amount increased rapidly. There was apparently no storage of glycogen as was the case with fats.

The monthly analyses of egg-masses (table 4) showed some fluctuations in moisture content with an increase in total and soluble ash. The fats decreased materially and some increase in total nitrogen. It is of interest that the larvæ taken from the egg-shells (table 2) increased gradually in nitrogen content. The carbonates and sulfates, considered to be a part of the end products of the life processes, increased in the egg-masses. It may be seen that the percentage of soluble ash of the larvæ encased in the egg-shells decreased somewhat. The end products were apparently deposited in the egg-shells.

The initial purpose of the study was an inquiry in the general changes and fluctuations of the chemical constituents of an in-

sect to obtain, if possible, an insight into the accumulation and decomposition of materials utilized in the life processes. The need for correlation of biochemical changes taking place in the life cycle of insects with environmental conditions, food plants, composition of soils, etc., is apparent. Such studies require long and painstaking work without much hope for immediate practical results. Every small contribution will help in the understanding of the vast problems involved and may bear fruit in the future. The studies reported are only a small part of the envisioned work and the results are far too scanty to allow general conclusions to be drawn. Correlation between the gross biochemical changes and the types and amounts of enzymes present during the different stages; types, fluctuations and quantities of intermediate products (sugars, amino-acids, etc.); occurrence and quantities of other inorganic constituents (phosphorus, potash, silicon, etc.) all would be necessary to complete the picture before real progress could be made with comparisons of food plants, geochemical factors and climatic conditions.

REFERENCES

- (1) Rudolfs, W. Jour. N. Y. Entom., v. 34, p. 249; v. 34, p. 320; v. 35, p. 220; v. 37, p. 17.

COCOON PARASITES OF THE ORIENTAL FRUIT MOTH*

BY BYRLEY F. DRIGGERS

ASSOCIATE ENTOMOLOGIST, NEW JERSEY AGRICULTURAL EXPERIMENT
STATION

There has accumulated in the past fifteen years a considerable body of literature which deals with parasites of the oriental fruit moth. In nearly all parts of the United States and Canada, where the moth has become established, are records of one or more species of insects which attack it. The number of parasites which have transferred to the fruit moth and the rapidity with which this has been accomplished is much more pronounced than in the case of certain other imported pests. Garman (3) reported an egg parasite (*Trichogramma*) and a larval parasite (*Macrocentrus*) of the fruit moth as early as 1917, one year after the first published note on the presence of the fruit moth in this country. This report was followed shortly by another report by Garman (4) and also by reports from Wood and Selkregg (9) and Stearns (7) which increased considerably the number of known species of fruit moth parasites. The spread of the fruit moth and the initiation of more and more studies dealing with its parasites added new species to the record from year to year. Stearns (8) and Haeussler (5) drew up lists of known fruit moth parasites. Haeussler's list, published in September, 1930, two years after that of Stearn's, contained 57 primary and 8 secondary parasites. These figures represent a gain of about 20 new species during the two year period. Since 1930 the writer has learned of a number of new species not recorded in Haeussler's paper. No doubt the number at present is much higher and will continue to increase.

A study of the literature of fruit moth parasites reveals the fact that the majority of the parasites recorded are those that attack the larvæ feeding in twigs and fruit. In a column

* Paper of the Journal Series, New Jersey Agricultural Experiment Station, Department of Entomology.

headed "stage of host attacked," Haeussler (5, p. 366) lists the egg, larva, pupa, prepupa and cocoon as the stages in the life cycle of the fruit moth attacked by the different parasites. Thirty-nine of the fifty-seven primary parasites are listed as larval parasites. Stearns (8) lists nearly twice as many primary larval parasites as all other primary parasites combined. Practically all of the parasites so listed attack the larva during the feeding stage and before it spins its cocoon.

A study of the data in the papers cited and other papers would lead one to believe that the largest number of parasite species, and the most important ones, attack larvæ at the time they are feeding in the twigs and fruit or while they are transferring from one feeding point to another. This may or may not be true. There may be as many or more species attacking the cocoon stages of the fruit moth as there are attacking the precocoon stages, and they may be as important. Up to the present time, most of the work on fruit moth parasites has dealt with stages of the moth other than those within the cocoon. This was the logical point to begin a study of fruit moth parasites. The precocoon stages of the fruit moth are present in the orchard from spring until fall; they are readily located, are easily collected in large numbers, and can be reared to maturity, or until the parasites emerge, with a minimum of effort. On the other hand, the cocoon stages—particularly those of the summer—are relatively less easily located and require more careful handling to prevent injury to the host or the parasite. While up to the present, emphasis has been placed on the study of parasites of the precocoon stages of the fruit moth, the writer feels that more study of the parasites of the cocoon stages is needed. One or more stages of the fruit moth in the cocoon are present in the orchard practically the whole year. Furthermore, the fruit moth, from the time the larva leaves its feeding place until the cocoon is spun and on through the larval, prepupal and pupal stages within the cocoon, is particularly susceptible to attack by parasites. A thorough study of the cocoon parasites in different parts of the country may bring forward a species more favorable for mass production and liberation than *Macrocentrus* or *Trichogramma*.

The interest of the writer in cocoon parasites was aroused soon after he was assigned to the fruit moth problem in 1927. In the spring and summer of 1927, and the two previous years, weekly collections of twig feeding larvæ were made in several localities in northern New Jersey and several in southern New Jersey. It was observed (2, p. 4) that, in general, the first brood twig larvæ in southern New Jersey localities were parasitized heavily whereas the larvæ of the first brood in northern New Jersey were parasitized lightly. The build up of the moth in succeeding generations in northern New Jersey was not as pronounced as one would expect from the low parasitism of twig feeding larvæ of the first brood. This led to the thought that other stages and particularly the cocoon stages might be heavily parasitized. Collections of fruit moth hibernacula were begun in the late winter and spring of 1928 for the purpose of determining the percentage of parasitism and the kind of parasites. Some of the parasites obtained from this material and from fruit moth pupæ exposed in the orchard in 1928 were recorded in a paper (1) printed in the journal of this society in 1930. These studies were continued in the summer of 1928, in 1929, and 1930. This paper sets forth some of the data obtained.

PARASITISM OF COCOONS COLLECTED IN THE SPRING OF 1928

Collections of fruit moth hibernacula were made from the rough bark of peach tree trunks and large limbs at the three northern localities, New Brunswick, South River and Glen Moore and from the southern New Jersey locality of Riverton. An effort was made to collect the hibernacula with as little disturbance to the contents as possible. In about half of the material collected the cocoons were mutilated to a point where the larva, pupa or parasite was exposed. The specimens thus collected were placed each in individual vials, suitably recorded and stored in an open insectary to await emergence. Collections were made at New Brunswick, April 20, 26, 29 and May 4; at South River, March 26, April 12 and 30; at Glen Moore, April 7 and May 3; and at Riverton, on March 27 and April 30. Table 1 shows the total number of individuals collected and the percentage parasitized.

TABLE 1

PERCENTAGE OF PARASITES AND MOTHS OBTAINED FROM ORIENTAL FRUIT
MOTH HIBERNACULA COLLECTED IN MARCH, APRIL AND MAY,
1928, AT FOUR LOCALITIES IN NEW JERSEY

Locality	Hibernacula collected	Fruit Moths, per cent.	Parasites, per cent.
New Brunswick	96	12.5	87.5
South River	88	26.2	73.8
Glen Moore	60	21.7	78.3
Riverton	27	74.1	25.9

The data in table 1 may appear as a rather small number of hibernacula collected. It should be borne in mind, however, that the collections were made in the spring after the natural winter mortality had taken place. The winter mortality, due to diseases and other causes, may be rather high (5, p. 377, and 6, p. 26). The practice of treating the trees with paradichlorobenzene in the fall is another factor which would tend to cut down the number of larvæ to be found on the tree the following spring.

The data in table 1 show a rather high percentage of parasites present in the collections at the three northern New Jersey localities, New Brunswick, South River and Glen Moore. At New Brunswick and South River approximately half of all the parasites were a species of *Eurytoma*.¹ *Calliephialtes* n. sp. was also fairly abundant at these localities, and was followed in much smaller numbers by *Aenoplex betulaecola*, *Eupelmus* sp. and *Pristomerus ocellatus*. At Glen Moore the parasites were about equally divided between the three species, *Eurytoma* sp., *Calliephialtes* n. sp. and *Eupelmus* sp. At Riverton *Calliephialtes* n. sp. was the most numerous parasite.

No specimen of *Glypta* or *Macrocentrus* was reared from any of the collections. *Pristomerus ocellatus* was known to be a parasite which attacks a precocoon stage of the fruit moth. *Calliephialtes* and *Aenoplex* appeared to be a primary parasite which attack the cocoon stage. *Eurytoma* and *Eupelmus*, on the other hand, appeared to be hyperparasites attacking *Glypta*

¹ The parasites were identified by specialists at the National Museum in Washington, D. C.

rufiscutellaris. The fact that these two hyperparasites were present in large numbers in the spring of 1928 and was followed by a marked decrease in the percentage of *Glypta* in the summer of 1928, has been noted (2, p. 16).

PARASITISM OF COCOONS COLLECTED SPRING OF 1929

The collections of hibernacula were continued in March and April, 1929, in the same orchards where the collections were made in 1928. The procedure used in collecting and handling the material was the same as was employed in 1928. Table 2 shows the percentage parasitism found in the spring of 1929.

TABLE 2

PERCENTAGES OF PARASITES AND MOTHS OBTAINED FROM ORIENTAL FRUIT
MOTH HIBERNACULA COLLECTED IN THE SPRING OF 1929
AT FOUR LOCALITIES IN NEW JERSEY

Locality	Hibernacula collected	Fruit Moths, per cent.	Parasites, per cent.
New Brunswick	116	50.0	50.0
South River	52	84.6	15.4
Glen Moore	32	87.5	12.5
Riverton	36	58.3	41.7

The data in table 2 show a decided drop in cocoon parasitism in the spring of 1929 as compared to the parasitism in the spring of 1928 in the three northern New Jersey localities. At Riverton the parasitism increased in 1929 over 1928. In general the same group of parasites were present in 1929 as were present in 1928. *Aenoplex* and *Calliephialtes* were again present as were the two hyperparasites, *Eurytoma* and *Eupelmus*. The parasite *Dibrachys boucheanus* appeared in larger numbers than the previous year. For the second year no specimen of *Glypts* or *Macrocentrus* was reared from the spring collected hibernacula.

The peach crop in New Jersey was more heavily infested in 1929 than any year since 1924. In orchards of the Belle of Georgia, Elberta and Fox Seedling varieties at Glen Moore, New Brunswick, South River, Dayton, and Manasquan, fruit infestations ranged from 30 to 80 per cent. The data in tables 1 and

2, while not extensive enough to warrant the drawing of a definite conclusion, point to a possible relationship between the parasitism of the cocoon stages and the subsequent build up in fruit infestation.

RELATIVE PARASITISM OF OVERWINTERING LARVÆ COLLECTED
IN THE FALL AND SPRING

The majority of the parasites obtained from the spring collections of 1928 and 1929 probably represented species that attack some stage within the cocoon and were not species that normally attack the feeding larvæ. This probability is strengthened by the fact that most of the species had never been reared from larvæ collected at the time they were feeding. Furthermore it has been shown (5) that the parasitism of larvæ cut from late ripening peaches is quite low. In order to throw further light on the question of where the parasitism found in the hibernacula in the spring took place, the writer carried out the following experiments from 1928 to 1930. Burlap bands were placed around Elberta and Krummel trees at New Brunswick in the late summer of 1928 and again in the late summer of 1929. The hibernating larvæ were removed twice a week from one-half of the bands, placed in vials with pieces of straw paper corrugations and the vials stored in the insectary to await emergence. The remaining half of the bands were left undisturbed until the following spring. They were then removed and the hibernacula, which the larvæ had constructed in and under them, collected and placed in vials for emergence records. The data from these experiments are set forth in table 3.

TABLE 3
COMPARATIVE PARASITISM OF OVERWINTERING LARVÆ COLLECTED IN THE
FALL AND SPRING AT NEW BRUNSWICK FROM BANDS PLACED
ON ELBERTA AND KRUMMEL TREES

When collected	Total no. collected	Fruit Moth, per cent.	Parasites, per cent.
Fall, 1928	79	96.1	3.9
Spring, 1929	74	56.8	43.2
Fall, 1929	462	94.3	5.7
Spring, 1930	282	65.6	34.4

The data in table 3 show that those larvæ that go over the winter on the tree are much more heavily parasitized than the larvæ collected shortly after they leave the fruit and begin constructing their winter cocoons. Since the spring and fall collected material came from the same source, the difference must be due to parasites which attack the cocoon stages. The small parasitism of the larvæ collected in the fall was made up principally of the two species of *Macrocentrus*—parasites which are known to attack the feeding larvæ.

The parasites obtained from the bands in the spring, collections were in general the same as those found in the spring collections of 1928 and 1929. *Aenoplex* was the most numerous, followed by the several species of hyperparasites previously mentioned. There was a scattering number of *Calliephialtes* and an occasional specimen of those species which attack feeding larvæ.

While collecting larvæ from under the bands in the fall of 1929, the writer found a number of larvæ in recently spun cocoons which at first examination appeared to be diseased. They were limp and flaccid, and showed no response to stimulation. Further examination of additional specimens showed that each larva had attached to it a tiny parasitic larva. A number of these paralyzed fruit moth larvæ were collected and an effort made to rear the parasites to maturity. Only one adult parasite was obtained. This proved to be a species of *Aenoplex*.

SUMMARY

A large number of species of insects have been recorded as parasites of the oriental fruit moth. To date most of the work has dealt with those species which attack the egg and feeding larva. In comparison, the species attacking the cocoon stages have been given little attention. Studies carried on in New Jersey from 1928 to 1930 show (1) that a high percentage of parasitism may be found in overwintering hibernacula collected in the spring, (2) that for the most part the species encountered are not the same as those found attacking the egg or feeding larval stages, and (3) that the majority of this parasitism takes place after the cocoon is formed or during the process of cocoon formation.

REFERENCES

1. DRIGGERS, B. F., 1929. Some Parasites of the Oriental Peach Moth in New Jersey. J. N. Y. Ent. Soc. Vol. 37: 169.
2. DRIGGERS, B. F. Some Studies on the Larval Parasites of the Oriental Peach Moth (*Laspeyresia molesta* Busck). N. J. Agri. Expt. Sta. Bull. 510.
3. GARMAN, P., 1917. The Oriental Peach Pest. Maryland Agri. Expt. Sta. Bull. 209.
4. GARMAN, P., 1918. A comparison of several species of Lepidoptera infesting peach and apple in Maryland, with additional notes on the Oriental Peach Moth. Maryland Agri. Expt. Sta. Bull. 223.
5. HAEUSSLER, G. J., 1930. Parasites of the Oriental Peach Moth (*Laspeyresia molesta* Busck) in North America. J. Agri. Res. Vol. 41: 366.
6. PETERSON, A., AND HAEUSSLER, G. J., 1926. The Oriental Peach Moth. W. S. D. A. circular 395.
7. STEARNS, L. A., 1919. Some recently recorded parasites of the Oriental Peach Moth. Jour. Econ. Ent. Vol. 12: 347.
8. STEARNS, L. A., 1928. The larval parasites of the Oriental Peach Moth (*Laspeyresia molesta* Busck) with special reference to the biology of *Macrocentrus ancylivora* Rohwer. N. J. Agri. Expt. Sta. Bull. 460.
9. WOOD, W. B., AND SELKREGG, E. R., 1918. Further notes of *Laspeyresia molesta*. J. Agri. Res. Vol. 13: 59.

LIFE HISTORY NOTES AND A STUDY OF THE EFFECTS OF HUMIDITY ON ADULT EMERGENCE OF RHAGOLETIS SUAVIS CRESS., FROM PUPAE AT A CONSTANT TEMPERATURE (DIPTERA, TRYPETIDÆ)¹

BY D. ELDEN BECK²

In Iowa, the walnut husk maggot, *Rhagoletis suavis* Cresson, infests the black walnut, *Juglans nigra* Linn., and the butternut, *Juglans cinerea* Linn., the most wide-spread infestation occurring in black walnuts. This paper is chiefly concerned with the insect in the black walnut.

During the latter part of September, 1930, several bushels of black walnuts were harvested, which were heavily infested with the husk maggot, the number of maggots ranged from one to thirty-six per nut. The nuts were divided into two lots, one lot being used to determine spring emergence and the other for a study of humidity and constant temperature effects.

Infested walnuts for outdoor study were placed upon the surface of loose humus soil in shallow boxes which were exposed to outdoor conditions throughout the fall and winter months. In the late spring of 1931, cheesecloth emergence cages were constructed and placed over the boxes containing the walnuts. The cages possessed sliding glass fronts which enabled one easily to count and collect the flies as they emerged.

The first fly emerged June 15, but no further emergence took place until July 6, when eight more flies were collected in the cage. Continued emergence of three or four individuals daily occurred during the month of July. A decided increase in the number emerging took place during the first of August and reached its highest point for the entire season on August seventh

¹ Contribution from the Department of Zoology and Entomology, Iowa State College, Ames, Iowa.

² The writer wishes to thank Dr. C. H. Richardson for his helpful suggestions in this investigation.

when thirty-eight flies were obtained. The last fly to issue appeared on the sixteenth of August.

The following procedure was followed for the humidity and temperature studies: Wooden boxes two feet square and four inches deep were partially filled with loose soil and a layer of infested walnuts was placed over the surface. The boxes were allowed to stand outdoors for a period of three weeks. Meanwhile great numbers of larvæ emerged from the walnuts and pupated a few inches beneath the surface of the soil. A large basin was provided into which one quarter of the box of soil containing the pupæ could be placed. The specific gravity of the pupæ was less than that of the surrounding soil particles and the pupæ which floated on the water surface were easily removed with a tea strainer. The pupæ were then immediately placed on blotting paper and allowed to dry for a few hours.

Pupæ so collected were placed in a wire screen cylinder over distilled water in a closed chamber, where the relative humidity was maintained at approximately 100 per cent. The chamber was opened daily for a few minutes for aeration.

The wire cylinder which contained the pupæ was removed from the high humidity chamber November 19, 1930. Ten pupæ were placed in each of a number of shell vials 60 mm. high \times 12 mm. wide and the vials were then maintained at 2° C. On December 4, four lots of 100 pupæ (10 vials to each lot) were removed and subjected to the following humidities: 32%–70%–81%–100%,³ at a constant temperature of 30° C.⁴ Each humidifier was a medium sized desiccator, the lower portion of which contained the saturated salt solution, while in the upper compartment were placed the shell vials in groups of ten on a wire screen. Each vial was loosely stoppered with cotton.

At intervals of every fifteen days new lots of pupæ were taken

³ Humidities were determined by use of the table constructed by Hugh M. Spencer in his "Laboratory Methods for Maintaining Constant Humidity." International Critical Tables, Vol. I, pp. 67–68, 1926.

The following were used to maintain the humidities: $\text{MgCl}_2 \cdot 2\text{H}_2\text{O} = 32\%$; $\text{NaCl} = 70\%$; $(\text{NH}_4)_2\text{SO}_4 = 81\%$; $\text{H}_2\text{O} = 100\%$.

⁴ Constant temperature and humidity apparatus for use in the experimental study of insects. T. A. Brindley & C. H. Richardson, Ia. State College, Jour. Sci. V, No. 4, pp. 211–221, 1931.

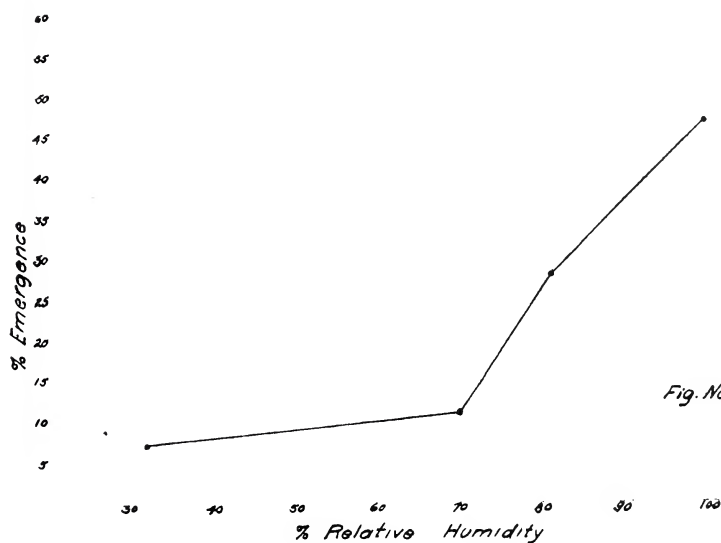
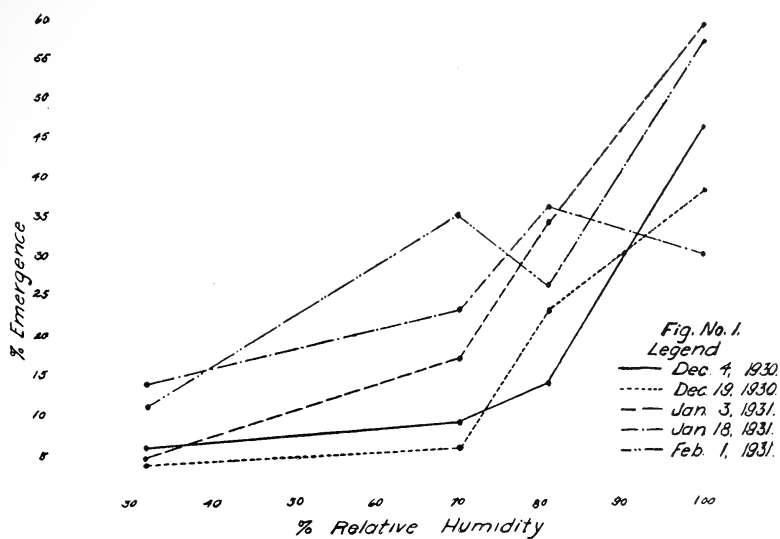
from the low temperature box and subjected to the above tests. The same procedure was continued until February 3, 1931.

On January 7, 1931, the first fly emerged. On the succeeding days regular emergence took place at the various humidities, continuing until the last of April, when very few flies remained.

Although preliminary, these tests indicate that humidity plays an important rôle in determining the percentage of adult emergence and it may be tentatively said with reference to *R. suavis* that the greater the percentage relative humidity, temperature remaining constant, the greater will be the emergence.

PLATE XXI

Figure (1) shows graphically the per cent. emergence of the various lots (December 4, December 19, January 3, etc.) at the respective humidities. In Figure 2 is shown the mean percentage emergence for the entire group at the different humidities, *i.e.*, the number of flies emerging regardless of the date removed from the low temperature chamber.



BOOK NOTICE

In Days Agone. By W. S. Blatchley, Nature Publishing Co., Indianapolis, 1932. 338 pp., 15 plates.

In this volume Mr. Blatchley has given, in diary form, notes on the flora and fauna of Florida, as he saw it in several journeys from 1911 to 1922. Visitors to Florida will find it interesting in its descriptions of the wilderness of twenty years ago; entomologists will appreciate the detailed accounts of the insects, many of which proved to be new species, which inhabited the then almost inaccessible regions into which Dr. Blatchley penetrated; but, most of all, true naturalists will rejoice in the possession of a book which discloses, between the paragraphs of scientific accuracy, the ardor which drove the author to seek continually new fields of research. Despite the physical fatigue and discomforts entailed by his journeys, despite the neuritis which caused the book to be written by the disabled author "propped up with cushions" (as we learn from a personal letter) he says "I spent many happy days in field and woodland, gathering first-hand knowledge of birds and reptiles, of insects and plants." The book, as a record of those "happy days," will be understandingly read by all who have had similar happy days afield; with admiration also for the author's ability to use his "first-hand knowledge" in the compilation of such useful books as his famous "Beetles of Indiana" his Orthoptera of North-Eastern America," the "Heteroptera or True Bugs of Eastern North America" and the Rhynchophora or Weevils of North America.

In 1931 Dr. Blatchley published "My Nature Nook," being notes on the natural history of the vicinity of Dunedin, Florida, where he has his winter home. "In Day's Agone" he treats of the natural history as observed in the southern part of the state, reserving for a future volume his observations made in Royal Palm Park since 1923. We trust it may be possible for Dr. Blatchley to complete this series of volumes that will no doubt increase in interest with the passing years.—Charles W. Leng and Wm. T. Davis.

BIOLOGY OF THE BIDENS BORER, EPIBLEMA
OTIOSANA (CLEMENS) (LEPIDOPTERA,
OLETHREUTIDÆ)*

BY GEORGE C. DECKER

AMES, IOWA

The bidens borer (*Epiblema otiosana* Clem.), a species indigenous to that portion of the United States lying east of the 100th meridian, is generally regarded as having little or no economic importance. It is, however, of considerable interest because it is an important insect enemy of a group of noxious weeds known as beggar ticks and, also, because it serves as a reservoir for important parasites of several injurious insects.

HOST PLANTS

The larvæ of this species normally feed within the stems of various species of *Bidens*. The writer has collected the borers from *Bidens frondosa* L., *B. cernua* L., *B. connata* Muhl. and *B. vulgata* Greene. It seems probable, therefore, that the larvæ will develop in still other species of this genus.

Overwintering larvæ of the bidens borer were also taken from stalks of *Ambrosia trifida* L., *Chenopodium album* L., *Solidago* spp., *Amaranthus retroflexus* L., *Polygonum* spp., *Typha* sp., and *Carex* sp., but in all cases it was quite evident that these plants were merely serving as shelter for larvæ that had wandered from their host and had then sought refuge in any suitable medium available. In one instance (in a plant of *Ambrosia trifida*) the presence of excrement indicated larval feeding had taken place but in all other cases the material in the burrow consisted of dry frass that had been ejected from the mouth.

Heinrich¹ lists *Bidens frondosa*, *Polygonum* and *Ambrosia* as food plants and it seems probable, therefore, that under certain conditions the borer breeds in plants other than *Bidens* spp.

* Journal Paper No. B41 of the Iowa Agricultural Experiment Station.

¹ Heinrich, C. Revision of the North American Moths of the Sub-family *Eucosminæ* of the family *Olethreutidæ*. U. S. N. M. Bull. 123, p. 154, 1923.

ECOLOGICAL CONSIDERATIONS

The bidens borer is quite naturally most abundant in low swampy areas and around lakes and streams where the *Bidens* plants are most abundant. It is not restricted, however, to these areas as many infestations have been found in *Bidens vulgata* on comparatively high and dry ground.

Moisture (rainfall) seems to be an important factor in inducing pupation of the overwintering larvæ. In the spring of 1927 a large number of *Bidens* plants containing borers were collected and divided into three lots. The first received normal rainfall; the second was protected from rain until June 20, when it was sprinkled with water and thereafter subjected to normal rainfall; and the third was kept dry until July 1. In the first case there was a normal emergence of moths beginning June 4, whereas in the second case pupation was greatly delayed, and emergence did not begin until July 9, and in the third case pupation did not occur. Toward the latter part of June most of the larvæ in this lot shriveled up and died. It should also be noted that no parasites issued from the third lot, whereas the first and second lots showed 62 and 54 per cent. parasitism, respectively.

On December 20, 1926, a number of larvæ were taken from plants that had been submerged in water and were frozen in the ice. In most cases water had entered the burrow and the borers were frozen in small cakes of clear ice. When this ice was melted and the larvæ gradually brought to room temperature they became active and crawled about in a normal manner. Early in February, larvæ taken from plants that had been submerged for about two months were alive and apparently healthy.

SEASONAL HISTORY

In Iowa the adults, developing from overwintering larvæ, begin to appear about the last of May and emergence continues until nearly the end of June. During the fore part of July the moths are usually scarce, but near the end of the month a second period of emergence begins and from that time until late in October the moths are always present. There are, however, two definite periods of maximum abundance. The first, which is the

largest, occupies the fore part of August, and the other occurs early in September. Thus, in the latitude of Iowa there appears to be three generations of *Epiblema otiosana* each year. One comes nearer stating the actual facts, however, by saying that there are two main broods and a small or partial third brood. Only the offspring from the moths emerging early in the season reach maturity in time to allow two broods to follow. At the same time it should be noted that the offspring of the last moths to emerge from the overwintering brood do not reach the adult stage until about the first of September and in this case there is barely time for the larvæ of the second generation to reach maturity in time to go into hibernation.

LIFE HISTORY AND HABITS

PUPA

There is nothing particularly distinctive about the pupa of this species. It is about one-half an inch, or slightly less, in length and varies according to age from light brown to chocolate brown in color. The abdominal segments are armed with transverse rows of minute spines which are used by the pupa in moving about in the burrow.

Pupation of the summer generations occurs within the stems of the *Bidens* plant. In the spring pupation occurs within the winter quarters of the larva.

The length of the pupal stage varies from 7 to 17 days and averages 11.2 days. As a rule pupæ of the overwintering brood and those of the second and third broods developing in September and October spend from 12 to 17 days in the pupal stage, whereas those of the summer broods spend only 8 or 9 days in this stage.

The overwintered larvæ normally pupate during late May and early June. The earliest recorded date for this brood was May 22, 1927, and the latest, June 29, 1927. Pupation of the first summer brood begins about July 20 and continues until late August; however, after the middle of August pupæ are always present in the field, and without knowing the history of the individual it is impossible to say whether it belongs to the first or second generation.

ADULTS

The adult is a small gray to grayish-black moth with characteristic white markings. It is about the size of a codling moth, which it somewhat resembles in shape and posture. As already mentioned the moths are practically always present during the summer months with periods of maximum abundance occurring in June, August and September.

The moths are nocturnal in habit, and during the day they remain hidden on the under side of leaves where they are seldom seen. When disturbed they are easily flushed and fly somewhat freely to the protection of another weed patch. Emergence occurs largely at night and mating usually takes place the first or second night following emergence. Egg deposition normally begins about dusk anywhere from the second to the fifth night after the emergence of the adult female. The oviposition period averages about 6 days in length and as a rule eggs are deposited each day during the period, with the greater number of eggs being deposited during the first two or three days. The largest number of eggs secured from a single female was 272 and the lowest 11. In captivity the moths nearly always laid less than 50 or more than 200 eggs, showing that the normal complement was between 200 and 250 eggs, but that for some reason about one-half of the moths refused to oviposit normally in cages; perhaps this also occurs in the field. The length of life for female moths was 9 to 18 days and for males 5 to 11 days. The males frequently died within 24 hours after mating.

EGG

The eggs are flat or scale-like, oval or elliptical in shape, and opaque white in color when laid. Within two days, however, they become somewhat transparent and two distinct red spots appear within each egg. The day before hatching the red spots vanish and the dark head of the now fully formed larva becomes the outstanding visible characteristic of the egg.

The eggs are deposited singly or in groups of two or three upon the leaves of the host plant. In the field about 75 per cent. of the eggs are laid on the underside of the leaves, whereas in cages they are deposited at random upon the sides of the cage and all parts of the plant.

The incubation period occupied from 4.5 to 15 days, depending upon the temperature. During the fore part of June, 1927, the eggs were exposed to a mean daily temperature of about 63° F. and required 15 days to hatch, whereas eggs deposited on July 9 of the same year received a mean daily temperature of approximately 80° F. and hatched in 4.5 days. Throughout the summer the mean temperature was about 74° F. and the average length of the incubation period was 6.1 days.

LARVA

The mature larva (Fig. 1) is about two-thirds of an inch long, yellowish-white in color and marked with fairly conspicuous

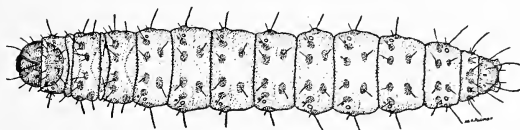


FIGURE 1. Mature larva of *Epiblema otiosana* (Clem.).

dark or blackish pinacula. Its head is amber or dark brown and the thoracic and anal shields yellowish-brown in color.

The number of larval instars varied from 5 to 7 but the majority of the larva completed development in 5 instars. Successive head capsule measurement (width) for larvæ having 5 instars were: 0.262 mm., 0.421 mm., 0.625 mm., 0.907 mm., and 1.30 mm. For those larvæ having more than 5 instars the head capsule width of the various instars was somewhat reduced. Variations in temperature from week to week produced marked variations in the length of the individual stadia and in the total length of the larval stage. In general, however, the first three or four stadia were about equal in length and the last two were somewhat longer than those preceding. The total length of the larval stage varied from 24 to 44 days and averaged 29.8 days. A glance at Table 1 will show the influence of temperature upon the length of the larval period. Larvæ hatching June 28, and July 7, 1929, were favored by normal July weather (72.9° F.) and reached maturity in 27 and 28 days respectively, whereas larvæ hatching July 22 and 31 encountered an unusually cool August (3.8° below average) and their larval period was extended to 33 and 36 days. Following the low temperatures in

TABLE 1
OBSERVATIONS ON THE LENGTH AND SEQUENCE OF LIFE CYCLES OF *Epiblema otiosana* (Clem.) AT AMES, IOWA

Genera- tion	Date of egg depo- sition	Date eggs hatch	Egg stage (days)	Date of pupation	Larval stage (days)	Date adults emerged	Pupal stage (days)	Length of life cycle	No. aver- aged
Over-winter				May 28, '26 Ju. 19, '26 May 22, '27 Ju. 10, '27 Ju. 29, '27 Ju. 3, '28		June 11 July 2-3 June 8 June 24-26 July 9-11 June 15-18	14.0 13.5 17 15 11 14 14.1		2 4 2 16 12 8
Average ..									
First	June 19, '26 June 30, '26 July 10, '26 May 28, '27 June 21, '27 July 1, '27 July 16, '27 June 20, '28	June 29 July 6 July 16 June 8 June 28 July 7 July 22 June 28	10 6 6 12 7 6 6 7.6	July 23-27 Aug. 2-6 Aug. 11-15 July 12-19 July 21-28 Aug. 1-8 Aug. 20-29 July 23-30	26 27.5 26.9 38 27.2 28.1 33 27.1 29.2	Aug. 2-6 Aug. 10-17 Aug. 20-24 Aug. 22-28 Aug. 1-8 Aug. 12-20 Aug. 29-S.9 Aug. 1-11	10 9.2 8.9 9.3 10.2 12.1 10.4 10.1 10.0	46 42.7 41.8 59.3 44.4 46.2 49.4 45.2 46.9	4 19 4 3 23 17 5 9
Average ..									
Second	Aug. 11, '26 Aug. 22, '26 July 25, '27 Aug. 4, '27 Aug. 16, '27 Sept. 2, '27	Aug. 17 Aug. 28 July 31 Aug. 12 Aug. 25 Sept. 8	6 6 6 8 9 6.8	Sept. 2-9 Sept. 8-14 Sept. 18-24	36 29.2 26 30.4	Sept. 11-18 Sept. 17-22 Oct. 4-11	8.5 8.6 16.1 11.1	50.5 45.8 51.1 49.1	11* 7* 4*
Average ..									
Third	Sept. 3, '27	Sept. 18	5						

* Only partial pupation occurred. Some larvæ went into hibernation.

August came unseasonably warm days (mean daily temperature above 80° F.) in early September and the duration of the larval stage for larvæ hatching August 25 was reduced to 26 days.

Upon hatching, the young larvæ of the first generation enter the plant as leaf miners or as bud worms. After feeding for two or three days within the leaves or buds they migrate and burrow into the main stem or into one of the larger lateral branches. Feeding within the stem the larva spirals downward so that the spiral burrow practically girdles the plant and the top immediately wilts. Decomposition starts and moves steadily down the plant behind the advancing larva which is moving downward at the rate of from one to one and one-half inches per day. Usually the first plant (if a seedling) is killed within a week or ten days, whereupon the larva migrates to another plant. Young larvæ of the second and third generations feed for several days in the buds, blossoms or seed heads of the plant. The second or third instar larvæ migrate to the main stems and proceed downward as before. By this time, however, the plants are quite sturdy and the larva may feed for sometime before the plant is seriously injured.

In preparation for pupation the mature larva drops to the bottom of the burrow and partitions off the upper part of the burrow with a plug of silk and frass. It then prepares an exit hole for the resulting moth, just below the plug, by removing the woody parts of the stem and leaving only the epidermis of the stem intact.

NATURAL ENEMIES

Four species of Diptera: *Lixophaga variabilis* Coq., *Muscina stabulans* Fall., *Masicera senilis* Mg. and *Sarcophaga cimbicis* Tns., and six species of Hymenoptera: *Bassus simillimus* (Cress.), *Epiuris pterophori* (Ashm.), *Microbracon caulicola* Gahn., *Apanteles harti* Vier., *Microbracon lutus* (Prov.) and *Macracentrus* sp. were reared as parasites from the larvæ of *Epiblema otiosana*. At times the combined efforts of these species resulted in seventy-five to eighty per cent parasitism of the borers collected in the field. It is of interest to note that several of the parasites of this borer are also the natural enemies of some other stalk borers including such destructive species as: *Papaipema nebris* (Gn.), *Pyrausta nubilalis* (Hubn.), and *Macronoctua onusta* Grote.

EURYMUS EURYTHEME IN MAINE

A note by the writer appeared in the JOURNAL OF THE NEW YORK ENTOMOLOGICAL SOCIETY (Dec. 1929) regarding the unusual appearance of *Eurymus eurytheme* Bdv., at Ithaca, N. Y. This southern butterfly appeared in Maine during the summer of 1932. Five females and one male were taken during late August and September at Bar Harbor, Mt. Desert Island. Collectors took three specimens and saw three or more additional ones during July and August in the Penobscot Valley about Lincoln and Enfield. This locality is north of the 45th parallel. Two specimens were seen by a collector near Northfield, about twenty miles from the New Brunswick border in southeastern Maine.

DR. A. E. BROWER.

THE ENTOMOLOGY OF THE "ORBIS PICTUS" OF
JOHN AMOS COMENIUS TOGETHER WITH
NOTES ON SEVERAL EARLY, AMERICAN,
ENTOMOLOGICAL JUVENILES

BY HARRY B. WEISS

NEW BRUNSWICK, N. J.

It is doubtful if many entomologists are familiar with the elementary entomology found in the "Orbis Pictus," the first children's picture book, written by Comenius, the eminent educator of the seventeenth century, and published in 1657. For a hundred years and more, this was a popular text-book in Europe and mothers instructed their children from its text and pictures. The first edition was published at Nuremberg, and a little later (1658) it was translated into English by Charles Hoole. In 1812 it was republished in America.

The author had very definite aims in mind when he wrote his book. He wanted to please the children with the pictures so that they would be happy to go to school. He wanted to arouse their attention and to take "especially flickering wits and prepare them for deeper studies." In his preface, he dwells at some length on how his book should be used in schools and it is evident from his remarks and advice that his practices contained the beginnings of systems later connected with the names of Pestalozzi and Stow.

The scope of the book may be determined by reading the title page of the 1728 London edition that accompanies these notes. The chief things of the world include animals, plants, minerals, fishes, the heavens, air, water, etc., and the employments of men cover hunting, fishing, cooking, merchandising, the tormenting of malefactors, fencing, and so many more that Comenius' "Orbis Sensualium Pictus" is indeed "a world of things obvious to the senses drawn in pictures."

JOH. AMOS COMENII
Orbis Sensualium Pictus:

HOC EST

Omnium principalium in Mundo
Rerum, & in Vita Actionum,

PICTURA & NOMENCLATURA.

JOH. AMOS COMENIUS'S
VISIBLE WORLD:

OR, A

Nomenclature, and Pictures

OF ALL THE

CHIEF THINGS that are in the WORLD, and
of MENS EMPLOYMENTS therein;

In above 150 COPPER CUTS.

WRITTEN

By the Author in Latin and High Dutch, being
one of his last ESSAYS; and the most suitable to Chil-
drens Capacity of any he hath hitherto made.

Translated into English

By CHARLES HOOLE, M. A.

For the Use of Young Latin Scholars.

The ELEVENTH EDITION Corrected, and the English made to
answer Word for Word to the Latin.

Nihil est in intellectu, quod non prius fuit in sensu. Arist.

London; Printed for, and sold by John and Benj.
Sprint, at the Bell in Little Britain, 1728.

Reproduction of title page of the 1728 London edition
of the "Orbis Pictus."

Two chapters or parts are devoted to entomology—such as it is—XXV, to “Flying Vermin” and XXXII to “Crawling Vermin.” These parts are reproduced as follows. The numbers in the text refer to the various insects in the illustrations.

Flying Vermin

XXV

Insecta volantia



The *Bee*, 1. maketh honey
which the *Drone*, 2 devour-
eth. The *Wasp*, 3.
and the *Hornet*, 4.
molest with a sting;
and the *Gad-Bee*
(or *Breese*), 5.
especially *Cattel*;
but the *Fly*, 6.
and the *Gnat*, 7. us.

The *Cricket*, 8. singeth

The *Butterfly*, 9. is a
winged *Caterpillar*.

The *Beetle*, 10. covereth
her wings with *Cases*.

The *Glow-worm*, 11.
shineth by night.

Apis, 1. facit mel
quod *Fucus*, 2. depascit
Vespa, 3.
& *Crabro*, 4.
infestant oculo;
& *Oestrum*
(*Asilus*). 5.
imprimis *pecus*.
autum *Musca*, 6.
& *Culex*, 7. nos.

Gryllus, 8. cantillat.

Papilio, 9. est
alata *Eruca*.

Scarabæus, 10. tegit
alas *vaginis*.

Cicindela Lampyris, 11.
nitet noctu.

Crawling-Vermin

XXXII

Insecta repentia



Worms gnaw things
 The *Earth-worm*, 1.
 the Earth.
 The *Caterpillar*, 2.
 the Plant.
 The *Grasshopper*, 3.
 the Fruits.
 The *Mite*, 4. the Corn.
 The *Timber-worm*, 5.
 Wood
 The *Moth*, 6. a garment
 The *Book-worm*, 7.
 a Book.
Maggots, 8.
 Flesh and Cheese.
Hand-worms, the Hair
 The skipping *Flea*, 9.
 the *Lowse*, 10.
 and the stinking
Wall-louse, 11. bite us
 The *Tike*, 12.
 is a blood sucker.
 The *Silk-worm*, 13.
 maketh silk.
 The *Pismire*, 14.
 is painful.
 The *Spider*, 14.
 weaveth a Cobweb,
 net for flies.
 The *Snail*, 16.
 carrieth about her Snail horn.

Vermes, rodunt res.
Lumbricus, 1.
 terram.
Eruca, 2.
 plantam.
Cicada, 3.
 Fruges.
Circulio, 4. Frumenta.
Teredo (cossis), 5.
 Ligna.
Tinea, 6. vestem.
Blatta, 7.
 Librum.
Termites, 8
 carnem & caseum.
Acari, Capillum.
Saltans Pulex, 9.
Pediculus, 10.
 fœtans *Cimex*, 11.
 mordent nos.
Ricinus, 12.
 sanguisguis est.
Bombyx, 13.
 facis sericum.
Formica, 14.
 est laboriosa.
Aranea, 15.
 textit Araneum,
 retia muscis.
Cochlea, 16.
 circumfert testam.

These two extracts will furnish one with a good idea of the plan of the entire work, although in justice it should be stated that the pictures of the insects are worse than those of any other objects in the book. I am sure that the illustrations of the "skip-ping flea," the "lowse" and other "crawling-vermin" did not "entice witty children" to them, nor did they "serve to stir up the attention."

Regardless of the lack of technical skill of the artist, if we except the entomological drawings which are meaningless, the illustrations are quaint and entertaining and no doubt amused and instructed the children.

* * * *

Among the numerous titles which circulated in the American nursery of long ago, we find certain ones on natural history. Many such books appeared after Goldsmith's "Animated Nature" had paved the way and made nature stories popular. In fact Goldsmith is supposed to have written, at the request of Newbery, such books as the anonymous "Jacky Dandy's Delight; or the History of Birds and Beasts in Verse and Prose" and "Tommy Trip's History of Beasts and Birds."

Gradually the number of natural history books increased; many were reprints of English accounts, and the publishers in America showed little or no originality. The same texts and illustrations in some instances were used over and over, the only changes being in the title pages and imprints. It may be of interest to mention some of the titles of these nature books, such as the "Children's History of Birds and Beasts" from the Sandbornton Press (1836); the "Natural History of Animals," published by Boyd and White, Concord, N. H. (1839), and by S. H. Colesworthy, of Portland, Me.; "Trip's History of Beasts; being a trifle for a good boy" printed by E. & E. Hosford, Albany, N. Y. (1818); "A History of Birds for the use of children," published by Rufus Merrill, Concord, N. H. (1843); "The History of Animals," published by J. Babcock and Son, New Haven, Conn. (1824), these being toy-books of from 8 to 32 pages and about $2\frac{1}{4}$ " x $3\frac{1}{2}$ " in size. Then there were the more ambitious ones such as "The Child's Book of Nature," published by Carter, Andrews, & Company, of Lancaster, Pa., with its colored plates;

A B C D E F G H I J K L M

N O P Q R S T U

V W X Y Z.

~~~~~  
a b c d e f g h i j k l m n o p

q r s t u v w x y z.

~~~~~  
A B C D E F G H I J K L

M N O P Q R S T U

V W X Y Z.

~~~~~  
a b c d e f g h i j k l m n o p

q r s t u v w x y z.

~~~~~  
A A A A A — f f f f f f f f.~~~~~
1 2 3 4 5 6 7 8 9 0.

Inside of front cover and title page of the 1821 edition of
 "The History of Insects."

THE

History of Insects.

And God made every thing that creepeth
 upon the earth. Gen. i. 25

~~~~~  
NEW-YORK.

PUBLISHED BY SAMUEL WOOD &amp; SONS,

NO. 261, PEARL-STREET;

And Samuel S. Wood & Co. No. 212, Market st.  
Baltimore.~~~~~  
1821.

the "Book of Birds," published by R. Merrill, Concord, N. H. (1851), running to 24 pages and of almost pamphlet size, 4 x 6 inches, and "A Concise Natural History of Birds," of 36 pages (3½" x 5¾"), published in Boston, Mass., by Thomas B. Wait and Co., and Charles Williams about 1817. Nor should Bewick's "Quarupeds" be forgotten.

As a rule the natural history books were generously illustrated, sometimes with engravings verging on the grotesque, but more often just dowdy. The smaller ones frequently carried a page devoted to the alphabet, and many were encased in colored wrappers, blue, yellow and green seeming to predominate.

One branch of natural history, however, was somewhat neglected. This was entomology. Toy-books about insects were, apparently, not numerous, probably because of the specialized nature of the subject and probably because of the little public

interest in that particular branch of natural history. Nevertheless a few toy-books on insects managed to circulate along with their more popular neighbors, those on birds and mammals. In 1816 Samuel Wood & Sons printed and sold at their juvenile book store, 357 Pearl Street, New York, a toy-book of 28 pages ( $4'' \times 2\frac{1}{2}''$ ) entitled "The History of Insects." After a quotation from Barbauld and a short introduction designed to impress one with the wonders of insects, fourteen examples are treated graphically and textually. Included therein are such common insects as the grasshopper, the cricket, the flea, the louse, the honey-bee, the dragon-fly and ants, and such uncommon ones, at least in this climate, as the elephant beetle, and the scorpion, which latter creature, of course, is not an insect. In the accounts, there is an attempt to supply facts of an interesting kind, but from an entomological view-point the statements are frightfully elementary and not always correct. However, this perhaps did not detract from the pleasure which the youthful readers obtained from handling the tiny books, and reading the accounts of something which perhaps they had already noted in the fields. The accounts are didactic in the extreme and have none of the unconscious humor which is so apparent in the text of some of our early toy-books.

The number of editions of the Samuel Wood & Sons' "History of Insects" is not known, nor is it known if the "History" appeared before 1816. However, in 1821 Samuel Wood & Sons, of 261 Pearl Street, and Samuel S. Wood & Co., No. 212 Market Street, Baltimore, published a "History of Insects" which, except for the changed imprint on the title page and the addition of covers (including various alphabets on page 2 of the cover), is identical with the 1816 edition. Perhaps the 1816 edition at one time had covers, in which event the two editions differ but slightly.

About 1860 Bailey & Noyes, of Portland, Maine, published "The History of Insects" as one of a series of twelve titles. This is a little sixteen-page, paper-covered book measuring  $3\frac{5}{8} \times 2\frac{1}{2}$  inches. It contains fewer accounts than the Wood "History of Insects," but the text of these is the same as the text in the Wood

6

**ELEPHANT-BEETLE**

The elephant-beetle is the largest of this kind hitherto known, and is found in South America, particularly in Guiana, about the rivers Surinam, and Oroonoko. It is of a black colour, and the whole body is covered with a shell, full as thick and as strong as that of a small crab. There is one preserved in the museum that measures more than six inches.

Pages 6 and 7 of the 1821 edition of "The History of Insects."

editions. The illustrations are different and much weaker than the Wood illustrations.

The specimen pages of these nursery books on insects, shown herewith, illustrate the character of the pictures and the entomological content of the text. They are both crude and elementary, and sometimes misleading, but perhaps they served a purpose in amusing and instructing the children and in stimulating their interest in natural history. As for their mistakes, most of us carry through life an amazing amount of misinformation on various topics, picked up through diverse channels and from various sources.

7

**GRASSHOPPER.**

Grasshoppers are too common to need description, as they abound almost wherever there is green grass. One summer only is their period of life; they are hatched in the spring, and die in the fall; previous to which, they deposite their eggs in the earth, which the genial warmth of the next season brings to life. They are food for many of the feathered race.



## BEES COLLECTED BY CHARLES DARWIN ON THE VOYAGE OF THE "BEAGLE"

BY T. D. A. COCKERELL

Several years ago I noticed among the undetermined bees in the Hope Museum at Oxford two species of *Halictus* collected by Charles Darwin. Last summer, being again in Oxford, I made descriptions of these, with the kind permission of Professor E. B. Poulton. One specimen, a female, was collected at Sydney, N. S. W.; the other, a male, came from Hobart Town, Tasmania. Both are black species of ordinary appearance. I went through all the collection of Australian *Halictus* in the British Museum, but neither of Darwin's species was represented. Returning home, I similarly went over my own collection, and found that the male differed in no essential respects, so far as I could make out, from *Halictus repertus* Cockerell. The female I was still unable to place, nor could I identify it with any of the few species absent both from my collection and that of the British Museum. If it seems singular that a bee collected at Sydney so long ago should still be new, it must be remembered that very little attention has ever been paid to *Halictus* in New South Wales, the list of species known from that state being very much shorter than the lists for Tasmania, Victoria or Queensland. In fact, when I was in the vicinity of Sydney I caught only a single species of *Halictus*, and it proved to be new. This was in 1928.

### *Halictus* (*Evylaeus*) *darwiniellus* new species.

♀. Black; anterior wing 6.6 mm. long; scape long, flagellum ferruginous beneath except basally; hair of head and thorax in poor condition, but pale; head rather large, ordinary, orbits converging below; clypeus convex, shining, with sparse punctures, the upper part with a shining median groove; supraclypeal area dull, top of head unusually narrow anteroposteriorly; cheeks poorly developed, in lateral profile not as wide as eyes; mesothorax convex, with no distinct median groove, moderately shining, with very numerous minute punctures; scutellum shining and finely punctured, basal area of mesothorax large, dull and granular, at sides with distinct though delicate plicæ, and a little shining; posterior truncation not sharply bor-

dered, seen from behind there is a transverse thickening in the middle at upper border; mesopleura dully minutely punctured; tegulae very dark brown, almost black, shining; wings greyish; stigma large, dull brown; nervures pale brown, outer recurrent and intercubitus very pale and weak; basal nervure very strongly bent, falling considerably short of nervulus; second cubital cell broad, much broadened below, receiving first recurrent nervure near to end; third cubital cell about or nearly as broad as first on marginal cell, and broadened below, receiving second recurrent nervure well before end; legs black, tarsi rufous at apex; hair on innerside of hind basitarsi light yellowish; hind tibiae with shining silvery whitish hair on both sides, but a broad band of dark chocolate posteriorly; abdomen broad, moderately shining, very finely and quite closely punctured; apical depressions of tergites broad, slightly brownish, in middle of second tergite quite or almost as broad as elevated part, and on third tergite broader than the elevated part; second and third tergites with basal bands of white tomentum, failing in middle; fourth tergite with a broad entire speckled band; apex with greyish brown hair; venter with white hair, not forming a scopa.

Sydney, N. S. W. (*Charles Darwin*). I use the diminutive form for the specific name, not only on account of the small size of the insect, but also because there is in South America a "darwinii" belonging to the Halictinae.

The wing is about as long as that of *T. lanarius* Smith, but that species (type examined) has a highly polished supraclypeal area, no groove on upper part of clypeus, area of metathorax different, and stigma red. *H. oblitus* Smith, which has a shining supraclypeal area, has a very dark stigma. *H. repraesentans* Smith has a quite different metathoracic area. *H. imitans* Ckll. is much too small. *H. asperithorax* Ckll. is closely allied, with the same sort of metathoracic area, and wings similar, but the dull mesothorax and the abdomen differ. *H. gilesi* Ckll. has quite a different metathoracic area. *H. granulithorax* Ckll. differs in the mesothorax, etc. *H. griseovittatus* Ckll. differs by the metathoracic area, more coarsely punctured mesothorax, etc. *H. supralucens* Ckll. has a polished supraclypeal area and polished apical part of metathoracic area.

#### **Halictus repertus** Cockerell

♂. Black; anterior wing about 4 mm. long; head practically circular seen from in front; scape short, shining black; flagellum very long, submoniliform, black, appearing greyish below; front entirely dull, supraclypeal area elevated, shining; clypus dullish, about the lower half light yellow,

the yellow angularly produced in middle above; face with white hair; mandibles partly rufous, but black at base; mesothorax convex, shining, finely punctured, with a median groove only in front; scutellum shining, finely punctured, not bigibbous; area of metathorax with strong but rather delicate radiating plicæ; posterior face margined at sides; tegulæ small, shining, very dark brown; wings hyaline, stigma large, very dilute yellowish brown; nervures pale but outer recurrent and intercubitus not especially weakened; basal nervure falling far short of nervulus; second cubital cell very narrow, receiving first recurrent nervure before end; third cubital cell broad, strongly bulging outward; legs black, with white hairs, tarsi yellowish-fulvous, becoming dark apically; abdomen shining, very finely punctured, margins of tergites narrowly rufous; no hair bands or spots.

Hobart Town, Tasmania (*Charles Darwin*). Compared with some other Tasmanian males, *H. baudini* Ckll. is much larger; *H. isthmalis* Ckll. differs in color of tibiae; *H. bassi* Ckll. and *H. blighi* Ckll. have the face dark; *H. boweni* Ckll. has darkened wings.

*H. repertus* was described from Victoria; one might expect the Tasmanian form to be racially distinct, but several species (*H. seductus* Ckll., *H. opacicollis* Ckll., *H. orbatus* Smith, *H. imitans* Ckll., *H. erythrurus* Ckll., *H. cyclognathus* Ckll.) occur both in Tasmania and Victoria, and apparently remain unmodified. The separation of Tasmania from Victoria is of quite recent date, geologically speaking. In typical *H. repertus*, the end of the abdomen has a red rounded plate, which I did not notice in the Darwin specimen, but it was probably somewhat retracted.

There is in the British Museum another Australian bee which may possibly have come from the "Beagle" expedition, but the accession book only shows that it was "bought at Mr. Children's sale" in 1840. It has a very curious history, as follows:

### *Reepenina testacea* (Smith)

*Tetralonia testacea* F. Smith. Cat. Hymenop. Ins. British Museum. Part II, Apidae (1854), p. 301. Africa.

*Nomia testacea* (Smith) Cockerell. Ann. Mag. Nat. Hist., Ser. 8, vol. iv. Oct., 1909. p. 311.

*Nomia* (*Reepenina*) *eboracina* Cockerell. Ann. Mag. Nat. Hist., Ser. 8, vol. ix. 1912, p. 377. Cape York, Queensland (*Froggatt*).

*Reepenia eboracina* Cockerell. Mem. Queensland Museum, vii. (1921) p. 81.

In the catalogue from Children's sale, it is marked "*Halictus*, Africa," and while this is incorrect as to the genus, it is nearer than Smith's assignment. The specimens never came from Africa, of course, but evidently were obtained by some expedition which visited Australia, and also Africa on the way home.

The following details are from the male type of *R. testacea*:

Eyes large; face narrow, entirely fulvous, ocelli large; antennae long, slender, fulvous, dusky toward apex; area of metathorax plicatulate, but sharply margined, posterior truncation covered with long hair; tegulae rather large, clear rufotestaceous; second cubital cell about square, receiving first recurrent nervure at about beginning of last third; basal nervure strongly arched, falling short of nervulus; stigma quite large; marginal cell rather pointed; a strong tubercle at each side of scutellum; hind legs simple; depression of first tergite very short, of others large; abdomen oval, shining dark reddish. The hind wing has a stigma, a character which is unique in *Reepenia*. One specimen shows the mouth parts, resembling those of *Nomia*, not at all of *Tetralonia*.

From the appearance of this bee, I feel confident that it must be nocturnal, but I have no actual evidence on this point.

The name *Nomia frieseana* Cockerell (*friesei* Cockerell, not Magretti) was proposed for the African *Nomia testacea* Friese. This will stand if we agree with Friese in treating *Reepenia* as a subgenus of *Nomia*. I consider *Reepenia* a valid genus, and shall recognize the name *Nomia testacea* Friese as valid.

## NOTES ON THE LIFE HISTORY OF MORPHO PELEIDES INSULARIS FRUHSTORFER\*

By C. REX STOLLMEYER

A female was captured at Curucaye, in the Santa Cruz valley, Trinidad, B. W. I., on March 26, 1929. An egg was obtained at 4:15 p. m. by pressing the abdomen. The egg measured 2 millimeters in diameter and was hemispherical in shape. The color was uniformly light emerald green.

*March 27:* Brown ring appears about half way on the egg; perfect circle in form but having breaks at regular intervals. Color of egg remains light emerald green.

*March 28:* Ring darker and breaks show very clearly.

*March 29:* No apparent change.

*March 30:* Top of egg appears somewhat dark as though the formation of the head of the caterpillar was taking place.

*March 31:* Light emerald green color disappearing and bottom of the egg getting whiter.

*April 1:* Very much paler in color and light brown spot forming close to and above a break in the circle.

*April 2:* Distinct dark brown mark showing near to and above ring which appears to be the head.

*April 3:* Egg very dark in places; towards evening outlines of caterpillar easily discernible.

*April 4:* Top of egg almost black and form of insect very apparent. Caterpillar emerged about 9:45 p. m. Length one-fourth inch; dark brown head with black hairs coming over the top from behind; body dark brown with three rectangular yellow markings on the back; a line of dark along either side of the body just above the legs.

*April 5:* The food plant is probably *Tanaecium crucigerum*, belonging to the family Bignoniaceæ. Very sluggish all day; took a very small section, not larger than the top of a large pin, out of the leaf.

\* Mr. W. J. Kaye has given a brief life history, from notes obtained from Mr. T. Potter of Trinidad, in *Memoirs of The Department of Agriculture, Trinidad and Tobago*, 1921, No. 2, pp. 47 and 48.

- April 6:* Seemed to have more life and ate more; rests under the leaf and remains in one place for hours at a time without moving.
- April 7:* Growing fairly fast and eating well. Moves only when ready to eat.
- April 8:* Measured one-half inch today.
- April 9:* Took photograph No. 1, 15 days from time of taking the egg, and five days after emerging from egg.\*
- April 10-12:* No apparent change.
- April 13:* About to make first moult and remained in same position all day. During the evening the head capsule began to come off.
- April 14:* First moult completed. Insect now has larger head with many more hairs behind the head, red in thickest part and a single row of white behind. Length one-half inch. White hairs come from both sides of the body with odd ones covering the entire insect on top and sides; color deep red directly behind the head followed by yellow then red again forming a large spot on the back about the center from which come two tufts of red hair pointing towards the tail at an angle of about 45 degrees. Very intricate markings and lines all over body in yellows, reds, browns. Ate nothing all day.
- April 15:* Found a good part eaten out of the leaf (about one-fourth inch square) in the morning and more eaten in the late evening. The food plant does not last for any length of time and it has to be replenished at least every two days. As soon as the water becomes stale the leaves dry up and turn black. They bruise very easily turning black wherever creased or crushed.
- April 16:* Insect measures nearly three-fourths inch in size now.
- April 17:* Eats well now and still remains under the leaf, occasionally on the top, for long periods of time without moving.
- April 18-20:* No apparent change.
- April 21:* Insect shows signs of second moult.
- April 22:* Second moult started; head capsule coming off.

\* Photographs numbers 1, 2, and 3 show two larvae. The records here given are of the smaller.



*April 23:* Moulded for second time. Length one inch. Head has long fine white hairs coming over from behind—not very thick—front of head has deep coloured claret hairs as also on top. There are two markings of yellow on the back; the first pear shaped with two tufts of red hairs leaning towards the tail at the bottom of the “pear.” Then follow thin lines of red and yellow curving in, then out, to form another yellow mark in the shape of an oblong. This second yellow marking has two tufts of red hairs leaning towards the tail similar to those of the first mark. Near the tail and about a quarter of the distance from the first tuft and second tuft there is another pair of red tufts of hair. Near the end of the insect there are many red and white hairs mixed together on either side of four parallel pairs of straight lines. Hairs (white) line both sides of the body above the legs. In front of head there is an inverted “Y” in yellow, the remainder being deep claret.

*April 24:* Seemed to have grown considerably overnight; it is now almost one and one-fourth inches.

*April 25:* Took picture No. 2, 31 days after getting egg, and 21 days after emerging from egg.

*April 26:* Insect eating well and remaining under leaf most of the time.

*April 27–May 2:* No apparent change.

*May 3:* About to moult for the third time.

*May 4:* Still in process of moulting; head capsule coming off.

*May 5:* Moulded for third time. Insect nearly two inches long and very fine looking.

*May 6–11:* No apparent change.

*May 12:* Took photograph No. 3 of both larvae. The record is of the smaller larva, which is now 38 days old.

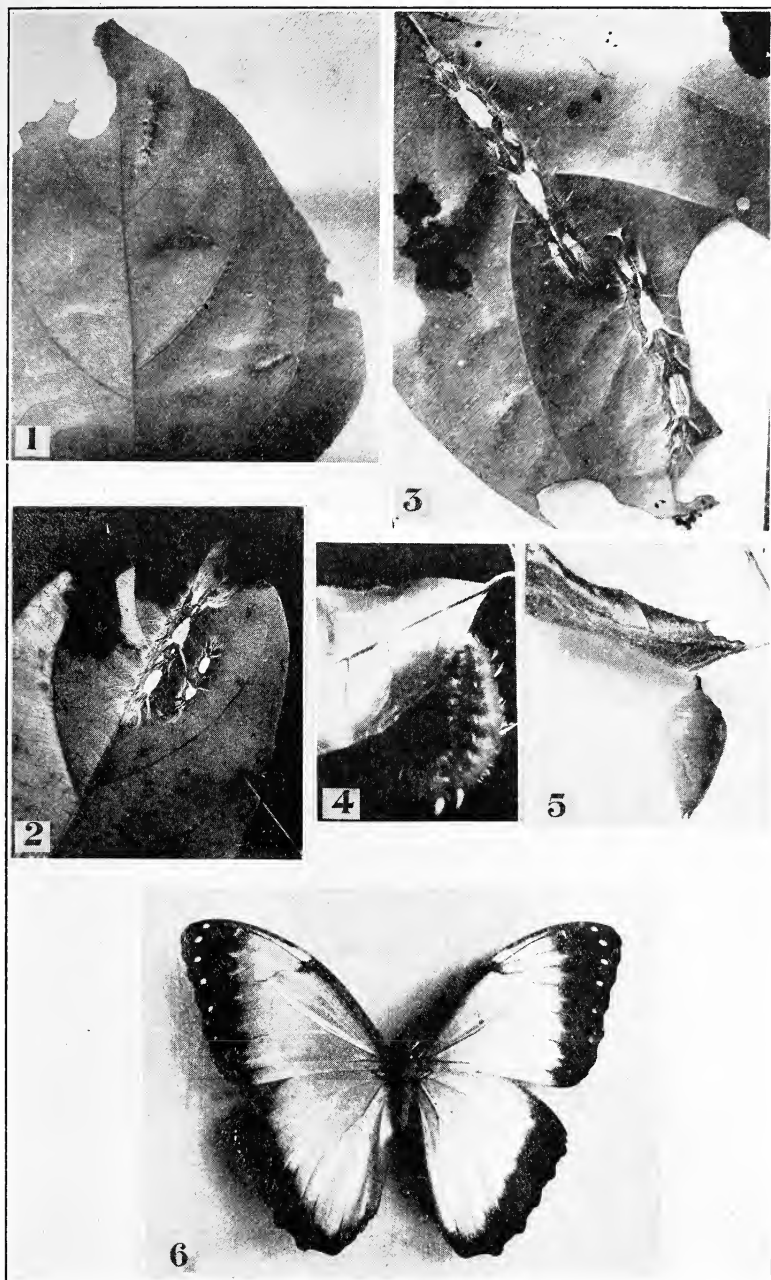
*May 13–16:* No apparent change.

*May 17:* About to moult for fourth time. Very sluggish; moves very little and eating at long intervals only.

*May 18:* Still moulting; head capsule slowly coming off, and insect seems to shrink.

*May 19:* Still moulting; head capsule nearly off.

- May 20*: Moulded for fourth time. Over two inches, about two and one-fourth inches in length; and very beautiful in appearance. Hairs, deep claret and white cover the body, which is yellow and deep red. A distinct "Y" in yellow marks the front of the head, from which small coarse bristles protrude. Two sets of tufts of hair (deep red) come from each third of the way down the body.
- May 21*: Eating well.
- May 22-June 3*: No apparent change.
- June 4*: Nearly two and three-fourths inches in length and one-half inch in width.
- June 5-7*: No apparent change.
- June 8*: Becoming very sluggish and losing much of its brilliant coloring.
- June 9*: Still sluggish but eating well.
- June 10-12*: No apparent change.
- June 13*: Color very dull and insect not eating much; moving very little.
- June 14*: Body appears to be shorter and thicker; dull brown in color with shades of pale green and olive.
- June 15*: Found the larva suspended from a leaf this morning and ready to pupate. Emerald green in color with hairs covering body like bristles. About one and one-half inches in length with head and front segments curving upward.
- June 16*: Took photograph No. 4.
- June 17*: Much thicker and greener.
- June 18*: Pupated early this morning; rich emerald green in color.
- June 19-29*: No apparent change.
- June 30*: Took photograph No. 5, of the chrysalis. Insect should emerge tomorrow as the formation of the wings is very evident through the thin filament covering. Largely black with spots of blue.
- July 1*: Wings, head and antennae of insect show plainly now; upper part of chrysalis olive green and below black with white spots.
- July 2*: Perfect male insect emerged this morning at 10:15 taking exactly 99 days from the day the egg was taken to the day the butterfly emerged. Photograph No. 6.



MORPHO PELEIDES INSULARIS

### NOTICE

It will be of interest to all workers in biology to learn that the Council of the Biological Society of Washington, at its last meeting, has voted the granting of a special price reduction on the following of its publications: "Natural History of the District of Columbia," by W. L. McAtee, 142 pages, inset map, octavo, paper, 1918. \$1.00. postpaid \$1.15; "The International Rules of Zoological Nomenclature," 28 pp. octavo, paper, 1926, 50¢; "Birds of the Washington, D. C., Region," by May Thatcher Cooke. 79 pp. octavo, paper, 1929, 50¢. These can be obtained, post paid, from the Society's corresponding secretary, J. S. Wade, U. S. Bureau of Entomology, Washington, D. C., at the prices indicated. Requests should be sent promptly as only a very limited number of copies remain.

## NEW SPECIES OF SERICA (SCARABAEIDAE), VI

BY R. W. DAWSON

UNIVERSITY OF MINNESOTA

The present paper is a continuation of a series run in this journal from 1919 to 1922. It is the hope and expectation of the writer to continue the work as rapidly as time and material permit, until all the species have been described and figured. The present number, in addition to presenting nine new species from California, reviews all but one of the remaining eastern species now known to the writer.

Under each species the citation is given concerning the deposition of the type, or of the specimen used in drafting the plate when the holotype was not available for that purpose. Measurements, except those otherwise cited, are made with a micrometer scale under the microscope, and translated into tenths of a millimeter. By this means slight differences in size and proportion may be presented with precision. Colors are first named in a general way and then noted according to Ridgway's "Color Standards." Descriptions, as well as drawings, are based on single, representative, type specimens.

The external characters of the various species are monotonously similar, and individual variation rather strong, so that the student must refer to the genital armature of the male for certain identification of his species. Even here some variation occurs, and judgment must be used in interpretation of the armatures, especially when the claspers are in unusual positions. Since so much depends upon the genital armature, which cannot be successfully described, the writer has drafted the figures with great care and mechanical precision.

***Serica chaetosoma*, new species.**

♂. Length 10 mm.; width 6 mm. Color dark brown (warm sepia), opaque with a slight grayish bloom or pollen on the elytra. Entire surface bristling with short, erect, fulvous hairs, perhaps more conspicuous than on any other species except *pilifera* Horn.

Clypeus of usual form with the margins only moderately reflexed, most strongly so at the angles which are prominent and more abruptly rounded

than usual. The prominence of the clypeal angles makes the anterior reflexed margin appear broadly emarginate at the middle. Clypeal puncturation fine, dense and confluent; suture fine and inconspicuous. Measurements of head: diameter through the eyes, 23; distance between inner eye margins, 15.5; extreme width of anterior reflexed margin, 14; antennal club, 8; dorso-ventral diameter of eye, 7.7. As the measurements indicate, the eyes are relatively small.

Pronotum only moderately convex, lacking the bloom seen on the elytra and in consequence appearing contrastingly deep reddish brown, surface with numerous, very fine but strongly setigerous punctures; sides almost evenly arcuate. Measurements of pronotum: greatest width, near posterior angles, 41; width through anterior angles, 24.5; median length, 25.

Elytra with intervals 1, 3, 5, etc., distinctly narrower than the alternating series, slightly costate and impunctate. The line-like striae appear vaguely defined. Punctures everywhere minute, but bearing strong, erect hairs which are definitely aligned on the striae, and in confused alignment down the center of the wider, flat intervals. Median length 8 mm.; greatest width 6 mm.

Genital armature of male (Pl. XXIII) with the left clasper truncate at the apex and of unusually simple form; length 3.7 mm.

♀. Differs from the male in being larger, more robust, with smaller antennal clubs, 6.5 instead of 8, and in having the pygidium strongly convex.

Type: ♂. Saticoy, California, June 11, 1926, (California Academy of Sciences).

Paratypes: 1 ♂, 2 ♀, all from California:

Saticoy, June 6, 1926, 1 ♂, 1 ♀; Santa Paula, June 15, 1926, 1 ♀.

***Serica ventura* new species.**

♂. Length 9 mm.; width, 5 mm. Color a light to middle shade of reddish brown, pronotum, burnt sienna, elytra dulled to hazel by a grayish bloom.

Clypeus with the discal area slightly tumid just below the middle; margins rather strongly reflexed; clypeal suture fine but distinct; clypeal notch obliterated; puncturation rather fine but deep, the punctures separated by about their own diameter. Measurements of head: diameter through the eyes, 21.7; distance between inner eye margins, 15; extreme width of anterior reflexed margin, 11; antennal club, 6.5; dorso-ventral diameter of eyes, 6.6.

Pronotum rather less convex than usual; showing the lateral piceous spots characteristic of the more pallid species; sides distinctly arcuate; surface shining, with fine but distinct punctures, separated by one to three diameters. Measurements of pronotum: greatest width, slightly in front of the



rounded hind angles, 36.5; through anterior angles, 23.5; median length, 20.5.

Elytra dulled by a gray bloom and showing traces of rainbow iridescence; striae line-like, each with a single row of small punctures spaced apart by one to two diameters; odd numbered intervals a little narrower than the even and vaguely costate, with very few punctures, the even numbered intervals nearly flat and with scattered punctures. Length 6.5 mm.; width 5 mm.

Margins of pronotum, elytra and basal segments of legs fimbriate with shaggy, yellow hairs. Metasternum and hind coxal plates with fine deep punctures separated by one to two diameters, surface shining and very thinly clothed with fine, short, yellow hair.

Genital armature of male (Pl. XXIV) with a distinctive, longitudinal median ridge and truncate apex on the short or left clasper; length 3 mm.

♀. With antennal club little if any smaller than that of the male, but with the pygidium distinctly more convex and shining.

Type: ♂. Saticoy, California, June 20, 1926, (California Academy of Sciences).

Paratypes: 29 ♂, 23 ♀, all from California:

Oxnard, 1 ♂; Santa Ana, 1 ♀; Santa Paula, 1 ♂; Saticoy, 3 ♂, 3 ♀; Ventura, 24 ♂, 19 ♀.

***Serica personata*** new species.

♂. Length 9 mm.; width 5 mm. Color dark brown (warm sepia to chocolate), elytra slightly gray pruinose, and with traces of rainbow iridescence in strong, shifting lights.

Clypeus and lower front strongly and densely punctured, the punctures separated by half, or less than half, their own diameter, and partially or largely obscuring the clypeal suture; clypeal margins only moderately reflexed, angles distinct, but little rounded, clypeal notch almost or quite obsolete. Measurements of head: diameter through the eyes, 22; distance between inner eye margins, 16; extreme width of anterior reflexed margin, 12; antennal club, 6.6; dorso-ventral diameter of eye, 7.2.

Pronotum moderately convex, especially in the anterior half; viewed from above with the sides nearly parallel to the middle, than strongly arcuate and convergent to the anterior angles; surface with small but deep punctures separated by about one diameter. Measurements of pronotum: width through posterior angles, 37.5; through anterior angles, 23.3; median length, 22.

Elytra with the characteristic line-like striae, each with a single row of punctures, but the latter much, or entirely, obscured by crowding from the rather close and strong punctures of the intervals; the odd numbered intervals usually distinctly narrower, with the punctures largely limited to the sides thus making them appear slightly costate, the even numbered inter-

vals wider and with numerous scattered punctures. Striæ, and to a lesser extent the wider intervals, bearing short, erect, golden-brown hairs.

Margins and under parts fimbriate with golden brown hairs. Metasternum and posterior coxal plates closely and strongly punctured.

Genital armature of male (Pl. XXV) closely resembling, but distinct from, that of *ventura*, length 3 mm.

Type: ♂. California, (Horn Collection, Philadelphia).

Paratypes: 12 ♂, 12 ♀, all from California:

California, 2 ♀; San Louis Obispo, 12 ♂, 10 ♀.

***Serica caliginosa* new species.**

♂. Length 10 mm.; width 5.4 mm. Color black with a rusty or piceous tinge; elytra with a grayish or frosty bloom.

Clypeus shining, with strong but rather small punctures separated by about half their own diameter; with a slight submarginal impression, and strongly reflexed edges. Clypeal notch shallow and feebly indicated; anterior reflexed margin, viewed perpendicularly, straight, at an angle from above, very slightly elevated at the middle, angles broadly rounded. Front opaque, with small feeble punctures separated by one to three diameters. Eyes relatively small and antennal clubs of moderate size. Measurements of head: diameter through the eyes, 25.5; distance between inner eye margins, 17.8; extreme width of anterior reflexed margin, 14.4; antennal club, 10.5; dorso-ventral diameter of eye, 7.7.

Pronotum rather strongly convex, with the sides almost evenly arcuate from base to apex, and fimbriate with coarse reddish brown hairs; surface opaque with a slight, grayish bloom; punctures fine and shallow, separated on the average by three to four diameters. Measurements of pronotum: width through posterior angles, 43.3; through anterior angles, 26.7; median length, 25.5.

Elytra with distinct line-like striæ, each with a row of small shallow punctures spaced apart by two to four diameters, but the definiteness of the row obscured by the irregularly placed, similar punctures of the alternate, distinctly wider intervals, 2, 4, 6, etc.; length 7.5 mm.; width 5.4 mm.

Beneath finely punctured and very sparsely covered with fine reddish brown hairs, becoming coarser, denser and more evident on the coxæ, femora and middle of the metasternum.

Genital armature of male (Pl. XXVI) somewhat resembling that of *personata* (a smaller, more delicate species often approaching *caliginosa* in color); length 3.2 mm.

♀. More robust with coarser and more conspicuous hair beneath; antennal club smaller, 7.7 instead of 10.5.

Type: ♂. White River, Tulare Co., California, April 14, 1905  
(Ralph Hopping), (California Academy of Sciences).

Paratypes: 5 ♂, 6 ♀, with the same data as the type.

***Serica acicula* new species.**

♂. Length 9 mm.; width 5.2 mm. Color testaceous (auburn), opaque with a silvery gray bloom or powder on the elytra.

Clypeus very feebly tumid just below the middle; margins gradually but strongly reflexed; lateral clypeal notch entirely absent; surface with small, distinct punctures separated by one-half to two-thirds their own diameter. Viewed perpendicularly, the anterior clypeal margin is nearly straight at the middle, and very broadly, evenly arcuate at the angles with the sides; viewed at an angle from above, slightly arcuate and more abruptly reflexed at the middle. Front with punctures less closely and regularly placed. Measurements of head: diameter through the eyes, 23.9; distance between inner eye margins, 15.5; extreme width of anterior reflexed margin, 11.7; antennal club, 8.3; dorso-ventral diameter of eye, 7.7.

Pronotum convex with sides strongly rounded anteriorly, and fimbriate, surface with fine shallow punctures separated by one to four diameters. Measurements of pronotum: width through posterior angles, 38.3; through anterior angles, 25.0; median length, 22.2.

Elytra with the even numbered intervals slightly wider than the odd; striae line-like with a single row of small punctures separated by one to three diameters; wider intervals with fine scattered punctures; lateral margins fimbriate; median length 7 mm.; greatest width, 5.2 mm.

Beneath sparsely clothed with fine, pale brown, shaggy hairs; metasternum and hind coxal plates shining, finely and densely punctured.

Genital armature of male (Pl. XXVII) with left clasper "aciculate"; length 3.25 mm.

♀. Differs from the male by the smaller antennal clubs, 6.7 instead of 8.3, and by the much more convex and shining pygidium.

Type: ♂. Hynes, California, April 29, 1921 (L. L. Muchmore), (U. S. National Museum).

Paratypes: 33 ♂, 10 ♀, all from California:

"Calif.", 4 ♂; "S. Calif.", ♂; Garden Grove, 5 ♂, 4 ♀; Hynes, 6 ♂, 2 ♀; Huntington Beach, 1 ♀; Los Angeles Co., 9 ♂; La Crescenta, 2 ♂; Los Angeles, 6 ♂, 3 ♀; San Gabriel, 1 ♀; Zuba Co. Buttes, 1 ♀.

***Serica pavonia* new species.**

♂. Length 8 mm.; width 4.7 mm. Color light brown or testaceous (hazel to russet), elytra with a beautiful rainbow iridescence in strong shifting lights—hence the name "*pavonia*."

Clypeus shining, finely and closely punctured, punctures separated by about their own diameter; clypeus very feebly tumid beyond the middle; clypeal notch obsolete or only faintly indicated; margins only moderately reflexed; anterior reflexed margin, viewed perpendicularly, strongly and

evenly arcuate, viewed at a strong angle from above, more prominent medially and at the rounded angles. Front semi-opaque with fine scattered punctures. Measurements of head: diameter through eyes, 21.5; distance between inner eye margins, 15.5; extreme width of anterior reflexed margin, 11.5; antennal club, 5.5; dorso-ventral diameter of eye, 7.2.

Pronotum only moderately convex; hind angles rounded and sides evenly arcuate; with mid-lateral, submarginal, piceous spot; punctures fine and shallow, separated by about two diameters, surface sub-opaque with traces of iridescence. Measurements of pronotum: greatest width, in front of posterior angles, 35.0; width through anterior angles, 22; median length, 19.

Elytra with line-like striae marked by single rows of fine, minutely setigerous punctures spaced apart by one to two diameters; intervals flat, the even numbered series very slightly wider than the odd and with fine scattered punctures, especially near the striae, the odd or narrower intervals with very few punctures. Length, 6 mm.; width 4.7 mm.

Margins and under surface moderately fimbriate with yellow hairs.

Genital armature of male (Pl. XXVIII) somewhat resembling that of *perigonia* but with the left clasper shortened and not ligulate at the tip as in that species; length 2.5 mm.

♀. More robust than the male and with slightly shorter antennal clubs, 5.0 instead of 5.5; pygidium slightly more convex and shining.

Type: ♂. Garden Grove, California, July 19, 1927, (California Academy of Sciences).

Paratypes: 10 ♂, 16 ♀, all from California:

"Calif.", 3 ♂, 5 ♀; Colton, 2 ♂; Garden Grove, 1 ♂, 1 ♀; Ontario, 2 ♂; San Bernardino, 3 ♂, 9 ♀; San Diego, 1 ♀.

***Serica falli*** new species.

♂. Length 8 mm.; width 4.3 mm. Color testaceous (amber brown to Brussels brown) elytra slightly gray pollenose.

Clypeus almost flat, margins moderately elevated; clypeal notch obsolete; clypeal suture distinct; punctures small but deep, separated by about their own diameter and showing a tendency to coalesce transversely. Front with puncturation sparse and variable. Measurements of head: diameter through the eyes, 21.7; distance between inner eye margins, 14.4; extreme width of anterior reflexed margin, 11; antennal club, 10.8; dorso-ventral diameter of eye, 7.2.

Pronotum not strongly convex, sides subparallel to the middle, then arcuately narrowed to the anterior angles; surface with fine, shallow punctures, separated by one to four diameters; with a submarginal, midlateral piceous spot. Measurements of pronotum: through posterior angles, 33; through anterior angles, 23; median length, 20.

Elytra with intervals almost equal, separated by line-like striae, each with a single row of fine punctures spaced apart by one to two diameters, but the rows somewhat obscured by crowding from the confused puncturation of the intervals. Length 6.5 mm.; width 4.3 mm.

Margins and under surface fimbriate with fine yellow hairs.

Genital armature of male (Pl. XXIX) nearly symmetrical and with the stalk more strongly arcuate than usual in the genus; length 2.5 mm.

Type: ♂. Owens Lake, California, May 14, 1917, (Collection of H. C. Fall).

Paratypes: 18 ♂, 3 ♀, all from California:

Olancha, Inyo Co., June 5, 1917 (Fox), 15 ♂; Owens Lake, May 12-14, 1917, 3 ♂, 3 ♀.

***Serica ligulata* new species.**

♂. Length 9.5 mm.; width 5.5 mm. Color chocolate brown (chocolate to bay), glabrous and sub-shining.

Clypeus feebly tumid at the middle of the apical third; margins rather strongly and suddenly reflexed, the sides elevated almost as much as the anterior margin; anterior reflexed margin viewed perpendicularly, broadly or arcuately emarginate between the prominent rounded angles, viewed at a strong angle from above, showing a median elevation which, with the prominent lateral angles forms an almost evenly crenate edge. Surface densely punctate, the punctures of moderate to small size but strong or deep, and separated by about one-half their own diameter. Clypeal suture fine but distinct. Front less closely punctured, and often a shade or two darker than the clypeus. Measurements of head: diameter through eyes, 24.5; distance between inner eye margins, 15; extreme width of anterior reflexed margin, 12; antennal club, 8.5; dorso-ventral diameter of eye, 8.5.

Pronotum moderately convex; sides arcuate only in the anterior two-fifths, sparsely and inconspicuously fimbriate with short brown hairs; surface closely and finely punctured, punctures separated by one-half to three diameters. Measurements of pronotum: width through posterior angles, 41; through anterior angles, 25.5; median length, 22.

Elytra approaching the typical sculpture of the eastern species of the genus, in that the intervals 1, 3, 5 etc., are only very slightly narrower than the alternate ones, and in that the striae are relatively wide, shallow grooves carrying three confused rows of punctures, however, in shifting lights the grooves show sharp line-like impression at the bottom. Punctures of moderate size, strong and separated by about their own diameter except on the crests of the intervals where they are widely scattered. Lateral margins of elytra feebly and inconspicuously fimbriate; median length 7 mm.; greatest width 5.5 mm.

Genital armature of male (Pl. XXX) symmetrical and showing strongly "ligulate" tips on the claspers; length 2.5 mm.



♀. Very similar to the male, but with smaller antennal clubs, 5.5 instead of 8.5.

Type: ♂. Kaweah, Tulare Co., California, 1,000 ft., April, 1911 (Hopping), (California Academy of Sciences).

Paratypes: 14 ♂, 1 ♀, all from California:

“Calif.”, 3 ♂; Fresno Co., 1 ♂; Huron, 2 ♂; Owens Lake, 1 ♂; Tulare Co., 1 ♂, 1 ♀; Kaweah, 5 ♂; Watson’s Spring, 1 ♂.

***Serica praetermissa* new species.**

*Praetermissa* is a counterpart of *ligulata* in external characters. The differences between the holotypes of the two species are not greater than the variations to be expected between individuals in a series of a single species.

The genital structures, in conjunction with the geographical distribution, however, indicate two species, a costal form *praetermissa* (Pl. 9), and an inland form *ligulata* (Pl. XXXI). As a supplement to the figure of *praetermissa* one should note that the position of the parts (which is characteristic of this form) is such as to obscure the much greater width of the basal end of the claspers, and their inward flexure which is like that figured for *ligulata*.

It may be that we are here dealing with a plastic species where several races will have to be defined, all under the name *ligulata*, but the radical armature characters scarcely justify that disposition of *praetermissa* at present.

Type: ♂. Paraiso Springs, California, June 26, 1926 (L. S. Slevin), (U. S. National Museum).

Paratypes: 9 ♂, 3 ♀, all from California:

“Calif.”, 1 ♂; Alhambra, 1 ♂; Carmel, 3 ♂; Pasadena, 1 ♂; San Diego, 2 ♂, 3 ♀; Vanderventer Flat, 1 ♂.

***Serica georgiana* Leng**

*Serica georgiana* Leng, Journ. N. Y. Ent. Soc., xix, p. 219, 1911.

The writer is indebted to Mr. Leng for the privilege of studying the type series, mounting the genitalia of the males, and drafting the figures (Pl. XXXII) here presented from the male holotype.

The species is easily recognized by the character of the armature in conjunction with the strong tumidity of the entire cly-



peal disk. The most closely related species, *lecontei*, differs by having the stalk of the armature more suddenly inflated, and the clypeus nearly flat, (Pl. ix, Vol. xxix).

Specimens examined: 105 ♂, 83 ♀:

New Hampshire: Manchester, 3 ♂.

Massachusetts: "Mass.", 1 ♂, 3 ♀; Blue Hills, 2 ♂; Bristol Co., 1 ♂; Cohasset, 2 ♀; Danvers, 1 ♀; Dracut, 1 ♀; Fall River, 9 ♂, 4 ♀; Forest Hills, 1 ♀; Framingham, 9 ♂, 3 ♀; Ipswich, 1 ♀; Marion, 1 ♂; Milton, 2 ♂; North Saugus, 1 ♀; Sherborn, 1 ♂, 1 ♀; Tewksbury, 2 ♂, 2 ♀; Tyngsboro, 7 ♂, 4 ♀; Wilmington, 1 ♂.

Connecticut: East River, 1 ♀; Guilford, 1 ♂; Lyme, 2 ♂; New Haven, 8 ♂, 3 ♀; Stamford, 1 ♀.

New York: "N. Y.", 1 ♂; New York City, 3 ♂; Brooklyn, 1 ♂; Buffalo, 1 ♀; Hudson, 1 ♀; Ithaca, 1 ♂, 1 ♀; Ramapo, 1 ♀; Staten Island, 2 ♀.

Pennsylvania: Charter Oak, 1 ♂, 2 ♀; Cresco, 1 ♀; Enola, 2 ♂; Forburg, 1 ♀; Inglenook, 3 ♂, 1 ♀; Marsh Run, York Co., 1 ♂, 2 ♀; Nalor's Run, Del. Co., 1 ♀; Nicholson, 1 ♂; Oil City, 1 ♂; Philadelphia, 3 ♂; Pittsburgh, 2 ♂, 1 ♀; Rockville, 2 ♂, 3 ♀.

New Jersey: Closter, 2 ♂, 2 ♀; Fort Lee District, 1 ♂, 1 ♀; Palisades, 1 ♂.

Maryland: Beltsville, 2 ♂, 1 ♀; Glen Echo, 2 ♂; Meyersville, 1 ♀; Plummer's Island, 2 ♂, 1 ♀.

District of Columbia: Rock Creek Park, 3 ♀; Washington, 3 ♂, 1 ♀.

Virginia: Penington Gap, 1 ♀.

Indiana: Brown Co., 1 ♀; North Vernon, 1 ♀.

Tennessee: Cumberland Co., 1 ♀; Fentress Co., 1 ♂, 3 ♀.

North Carolina: "N. C.", 1 ♂, 1 ♀; Andrews, 1 ♀; Ashville, 1 ♀; Black Mts., 5 ♂, 6 ♀; Cataloochee, 2 ♂; Crestmount, 1 ♂; Highlands, 3 ♂, 3 ♀, (paratypes) + 1 ♀; Hendersonville, 1 ♀; Retreat, 1 ♀; Sunburst, 2 ♀.

Georgia: Clayton, 1 ♂ (holotype), 1 ♀ (paratype); Rabun Co., 5 ♂.

Alabama: Le Roy, 1 ♂.

Texas: "Texas," 1 ♀.

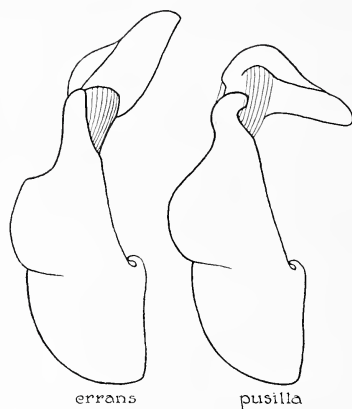
***Serica pusilla errans* Blatchley**

*Serica errans* Blatchley, The Florida Entomologist, xiii, p. 35, June, 1929.

*Serica errans* Blatchley, Blatchleyana, Nature Pub. Co., Indianapolis, 1930, p. 50, (holotype designation).

The writer is indebted to Mr. Blatchley for the privilege of studying the type series of *errans* and extracting the genitalia of the males.

Because of the great similarity between *errans* and *pusilla* it seems best to regard the two as forms of a single species, *pusilla*. The best and perhaps only certain criterion for their separation is the genital armature. The accompanying outline figures (supplementing the original drawing of *pusilla*, Pl. xvii, JOURN. N. Y. ENT. Soc., xxx) should make clear the distinguishing features. The most significant characters in the armature of *errans* are the obtuse angulation or prominence on the mid-dorsal line and the more nearly straight outline of the distal end of the stalk. Some of the differences, seeming at first glance to



obtain, between the two figures are the result of the position of the claspers, flexed basally, and partially rotated laterally in *pusilla*, and directed distally and nearly closed right to left, in *errans*. Thus the tension on the articular membranes is considerably modified, and the perspective of the claspers somewhat changed.

It is probably a good working hypothesis to assume that where any structure varies to an extreme degree between the species of a natural genus, as does the genital armature of *Serica*, one should also expect more than the usual individual variation in that structure within specific limits. Proceeding on this basis one would scarcely separate *pusilla* and *errans*. However, as additional material accumulates, intergradation should supply the evidence for synonymy, or conversely lack of intergradation, the evidence for varietal or even specific recognition.

The writer infers that Mr. Blatchley overlooked the description of *pusilla* when he described *errans*.

Specimens examined: 14 ♂, 4 ♀, all from Florida:

Dunadin, 3 ♂ and Ocala, 2 ♀, the type series; Gainesville, 9 ♂, 1 ♀.

To the best of the writer's recollection 1 ♂ from Orlando and 1 ♂, 1 ♀ from Tampa, seen some time ago, would be referable to the form *errans*.

### **Serica evidens** Blatchley

*Serica carinata* Blatchley, Coleoptera of Indiana, pp. 956-7, 1910.

*Serica evidens* Blatchley, Can. Ent., 13, p. 153, 1919, (new name).

*Serica evidens* Blatchley, Blatchleyana, Nature Pub. Co., Indianapolis, p. 36, 1930, (type designation).

The fine "carinate" line bisecting the front and following the clypeal suture, along with the fine, very dense puncturation of the head and pronotum should enable one to place this species rather easily. The male genital armature of Mr. Blatchley's holotype is figured on Plate XXXIII.

Specimens examined: 11 ♂, 22 ♀:

Illinois: White Heath, 1 ♂.

Indiana: (type series) Crawford Co., 2 ♀; Fountain Co., 1 ♀; Marion Co., 1 ♀; Posey Co., 1 ♂ (holotype), 1 ♀; Vigo Co., 1 ♀.

Iowa: Iowa City, 1 ♀.

Nebraska: Nebraska City, 3 ♀; Omaha, 1 ♀.

Kansas: "Kan.", 3 ♂, 1 ♀; Douglas Co., 3 ♂, 3 ♀; Lawrence,

1 ♂; Manhattan, 1 ♂; Riley Co., 1 ♂, 6 ♀.  
New Jersey: Riverton, 1 ♀.

**Serica intermixta** Blatchley

*Serica intermixta* Blatchley, Coleoptera of Indiana, p. 957, 1910 (in part).

*Serica intermixta* Blatchley, Blatchleyana, Nature Pub. Co., Indianapolis, 1930, p. 36 (holotype designation).

Mr. Blatchley's description of *intermixta* was drawn up from a composite series including *intermixta*, *loxia* and *campestris*. In 1918 all the specimens then remaining in his collection were kindly submitted to the writer for study. By mutual agreement between us the male holotype was selected, and as above noted, has recently been recorded by Mr. Blatchley. All determinations made by the writer have been based upon this agreement.

The figures here presented (Pl. XXXIV) of the genital armature are not from the holotype, but from a specimen carefully matched with it, in which the armature was in a more satisfactory condition for drawing. This specimen bears the data, "Queen's Park, Aylmer, Quebec, Sept. 26, 1924, (A. R. Graham)" and is being deposited in the U. S. National Museum for reference of future students.

The genital armature of *intermixta* is so distinctive and characteristic that nothing more is needed for positive identification. In fact the writer believes that a full description of the external characters would only hinder the recognition of the species by making students think they could recognize it by that means. The species is very wide ranging and variable, and grades so close to the variants of *campestris*, *lecontei*, *loxia*, *atricapilla*, *carolina* and others in turn, that only one with comparative material at hand and who has had some experience with the genus can be sure of identifying it without the aid of the genital armature. With this reservation the following notes are offered.

Clypeus relatively long and narrow, distinctly impressed near the margins, making the clypeal suture appear prominent or subangulate; clypeal notch narrow; anterior depressed area of clypeus with sparse, coarse, erect hairs. Eyes and antennal clubs of moderate size.

Specimens examined: 249 ♂, 170 ♀:

New Hampshire: "N. H.", 1 ♂; Manchester, 1 ♂, 1 ♀; Three Mile Island, 4 ♂, 2 ♀.

Massachusetts: Sherborn, 1 ♀.

Connecticut: Stonington, 1 ♂.

New York: Ithaca, 6 ♂, 2 ♀; Newport, 4 ♂; Peru, 1 ♀; West Point, 1 ♂.

New Jersey: "N. J.", 1 ♂; Riverton, 1 ♀.

Maryland: "Md.", 2 ♂, 3 ♀; Laurel, 2 ♀; Plummer's Island, 5 ♂; Plum Point, 1 ♀.

District of Columbia: Washington, 5 ♂, 4 ♀.

Virginia: "Va.", 1 ♂, 1 ♀.

Michigan: "Mich.", 1 ♂; Ann Arbor, 1 ♀; Bad Axe, 1 ♀; Charity Isl., 1 ♂; Douglas Lake, 3 ♂, 2 ♀; Marquette, 1 ♂, 1 ♀; Montmorency Co., 1 ♀; Port Huron, 1 ♂.

Wisconsin: Bayfield, 1 ♀.

Illinois: "Ill.", 5 ♂, 9 ♀; Algonquin, 2 ♀; Champaign, 1 ♀; Cook Co., 1 ♀; Rock Island, 1 ♂.

Indiana: Jennings Co., 1 ♂ (holotype); Lafayette, 2 ♀; Lake Co., 1 ♀ (paratype); Millers, 1 ♂; New Albany, 1 ♀; Vigo Co., 1 ♀ (paratype).

Tennessee: "Tenn.", 1 ♀; Fentress Co., 1 ♀.

North Carolina: Black Mts., 3 ♂, 1 ♀; Chapel Hill, 1 ♂; Durham, 1 ♂; Raleigh, 1 ♂; Southern Pines, 3 ♀.

South Carolina: "S. C.", 1 ♀; Columbia, 1 ♀.

Georgia: Macon, 1 ♂; Rabun Co., 1 ♀.

Florida: Gainesville, 2 ♂, 3 ♀.

Missouri: "Mo.", 2 ♀.

Iowa: Ames, 1 ♂; Ft. Dodge, 1 ♂; Lake Okoboji, 5 ♂, 1 ♀; Sioux City, 1 ♂.

Minnesota: "Minn.", 1 ♀; Duluth, 2 ♂, 1 ♀; Minneapolis, 9 ♂, 11 ♀; St. Paul, 1 ♂, 9 ♀.

North Dakota: Jamestown, 1 ♀.

South Dakota: Englewood, 5 ♂, 1 ♀; Spearfish Canyon, 1 ♂.

Nebraska: Hooper, 1 ♂; Monroe Canyon, 1 ♀; Neligh, 5 ♂; South Bend, 1 ♂; West Point, 3 ♂, 3 ♀.

Kansas: "Kan.", 5 ♂, 1 ♀.

New Mexico: "N. M.", 1 ♂; Gallinas Canyon, 1 ♂; Trout Springs, 1 ♂.

Colorado: "Col.", 4 ♂, 3 ♀; Colorado Springs, 1 ♂, 1 ♀; Douglas Co., 1 ♀; Durango, 1 ♂; El Paso Co., 1 ♂; Estes Park, 1 ♂; Ft. Collins, 1 ♂; Golden, 2 ♂, 1 ♀; Greeley, 1 ♀; Platte Canyon, 2 ♂, 1 ♀; Rist Canyon, 1 ♂; Williams Canyon, 1 ♀.

Arizona: Tucson, 3 ♂, 3 ♀.

Montana: Helena, 1 ♂; Maiden, 9 ♂; Monarch, 1 ♀.

Canada:

Ontario: W. Ontario, 1 ♀; Gull Lake, 7 ♂; Hastings, 1 ♂; Ottawa, 16 ♂, 14 ♀; Port Hope, 1 ♂, 2 ♀; Prince Edward Co., 1 ♀; Rostrevor, 1 ♂; Sudbury, 1 ♂; Toronto, 2 ♂; Trenton, 5 ♂, 1 ♀.

Quebec: Chelsea, 11 ♂, 8 ♀; Montreal, 2 ♂, 1 ♀; Aylmer, 1 ♂; St. Anne's, 1 ♂; St. Johns, 12 ♂; St. Therese Isl., 9 ♂; Three Rivers, 4 ♂, 1 ♀.

Manitoba: Aweme, 12 ♂, 9 ♀; Melita, 1 ♀; Miami, 1 ♂, 1 ♀; Onah, 5 ♂, 5 ♀; Wawansea, 1 ♂; Winnipeg, 13 ♂, 13 ♀.

Alberta: Edmonton, 12 ♂, 7 ♀.

British Columbia: "B. C.", 1 ♀; Cawston, 1 ♂, 2 ♀; Savana, 2 ♀.

North West Territory: "N. W. T.", 2 ♀.

***Serica sericea* Illiger**

In 1922 *sericea* was redescribed (JOURN. N. Y. ENT. SOC., xxx, p. 154) and neotypes were designated in the belief that Illiger's specimens were no longer extant. Recently through the kindness of Dr. Heinrich Kuntzen of Berlin the writer has been permitted to examine Illiger's type series of five specimens. Like several other type series it is composite. One male and two females are *mystaca*, one male *parallela* and one female the *sericea* of American authors of the past century. This female specimen, labelled "Georgia, Francillon, Knoch collection," is here designated as the holotype of Illiger's species *sericea*. Fortunately there is neither justification, nor necessity for disturbing the nomenclature of the three species concerned.

***Serica atricapilla* Kirby**

*Camptorhina atricapilla* Kirby, Fauna Boreali-Americana, iv, p. 129, 1837.



*Serica cucullata* Dawson, JOURN. N. Y. ENT. SOC., xxvii, p. 34, 1919.

It is certain that Kirby had several specimens, since he says in the original description: "Taken in Canada by Dr. Bigsby, and in Nova Scotia by Capt. Hall." There is every probability that his series contained *intermixta*, the prevailing Canadian species, *lecontei*, which must have given the inspiration for the name "black-capped" and which probably accounts for Le Conte's recorded synonymy with *vespertina*† (Le Conte not Gyllenhal), and *cucullata*. A single female specimen of his material remains, and is deposited in the British Museum where it is held to be the holotype. The writer is indebted to Dr. C. E. Mickel and Dr. Gilbert Arrow for carefully comparing in joint session all the North American species which theoretically might be concerned, and for making a positive identification with the species *cucullata*.

The known range of *atricapilla* has been extended into eleven new states since the publication of the description of *cucullata*. It therefore seems desirable to record all the data.

Specimens examined: 131 ♂, 63 ♀:

Maine: Paris, 1 ♀; Salisbury Cove, 1 ♂.

New Hampshire: Mt. Moosilauke, 1 ♂; Three Mile Island, 1 ♂, 1 ♀; Walpole, 1 ♂.

Vermont: St. Johnsbury, 1 ♂.

Connecticut: Cornwall, 1 ♂; Colebrook, 1 ♂.

New York: Allegany Park, 1 ♀; Cranberry Lake, 6 ♂; Ithaca, 6 ♂, 4 ♀; McLean Bogs, 2 ♂; Newport, 3 ♀; Peru, 1 ♀; Saranac Inn, 2 ♂; Sullivan Co., 1 ♂; Trenton, 1 ♂, 1 ♀.

Pennsylvania: Allegheny Co., 1 ♂; Inglenook, 1 ♀; Jeanette, 1 ♂; Pittsburgh, 2 ♂; York Co., 1 ♀.

New Jersey: Bergen Co., 1 ♀; Closter, 1 ♂.

Maryland: Glen Echo, 2 ♀; Hyattsville, 2 ♂; Jackson's Island, 1 ♂; Laurel, 1 ♂; Plummer's Island, 2 ♂.

District of Columbia: Washington, 5 ♂.

Virginia: "Va.", 1 ♂; Falls Church, 3 ♂; Great Falls, 2 ♂, 1 ♀.

Michigan: Beaver Island, Charlevoix Co., 4 ♂, 1 ♀; Big Stone Bay, 1 ♂, 1 ♀; Charity Island, 2 ♂; Detroit, 2 ♂;

- Douglas Lake, 3 ♂, 2 ♀; Eagle Harbor, 1 ♂; Eagle River, 1 ♂; High Island, 3 ♂; Lake Superior, 1 ♂; Mackinac Co., 2 ♂; Mackinaw City, 2 ♂; Marquette, 9 ♂, 4 ♀; Point Austin, 1 ♂; Pellston, 1 ♀; St. Ignace, 4 ♂.
- Wisconsin: "Wis.", 1 ♀; Cranmoor, 1 ♂; Trout Lake, 1 ♂.
- Illinois: Chicago, 1 ♀.
- Tennessee: Burrville, 1 ♀.
- North Carolina: "N. C.", 2 ♂; Black Mts., 3 ♂, 2 ♀; Cataloochee, 1 ♂; Round Knob, 1 ♂; Sunburst, 1 ♂.
- Georgia: Clayton, 1 ♂, 1 ♀.
- Florida: Gainesville, 1 ♂.
- Alabama: Baldwin Co., 1 ♂.
- Minnesota: Duluth, 1 ♂, 3 ♀; Itasca Co., 2 ♂, 4 ♀; Lake Itasca, 2 ♀; Minneapolis, 20 ♂, 13 ♀; St. Paul, 1 ♀.
- Canada:
- Ontario: Gull Lake, 2 ♂; Hastings Co., 1 ♀; Ottawa, 1 ♂, 1 ♀; Sudbury, 1 ♀.
- Quebec: Hemmingford, 1 ♂; Montreal, 2 ♂; Murray Bay, 1 ♂, 1 ♀; St. Therese Island, 1 ♂; Seven Islands, 1 ♀.
- New Brunswick: St. John, 1 ♀.
- Nova Scotia: "N. S.", 1 ♂; Kentville, 1 ♂.
- Manitoba: Aweme, 1 ♂; Winnipeg, 1 ♂.
- British Columbia: "B. C.", 1 ♀.

### ***Serica trociformis* Burmeister**

*Serica trociformis* Burmeister, Handbuch Ent., iv, 2, p. 179.

*Serica trociformis* Le Conte, Journ. Acad. N. S., Phil., Ser. 2, iii, p. 277.

To again describe *trociformis* is unnecessary, but a supplement to the recorded information is needed. Through the courtesy of Dr. Walther Horn the writer was permitted to examine Burmeister's type series of five specimens. They are exactly like the form collected at Southern Pines, North Carolina, by the late A. H. Manee, and distributed by him to many collections. The pronotum is shining and glabrous, evenly convex, entirely lacking the median groove expanding basally as described by Blatchley.

The accompanying figure of the genital armature (Pl. XXV) is from a specimen deposited in the U. S. National Museum, and

bearing the label "Southern Pines, N. C., iv, 23, '12, A. H. Manee."

Specimens examined: 137:

South Carolina: 5 specimens, Burmeister's type series.

North Carolina: Aberdeen, 9 ♂, 12 ♀; Eagle Springs, 17 ♂, 23 ♀; Ellerby, 5 ♂, 3 ♀; Southern Pines, 33 ♂, 26 ♀; White Lake, 1 ♂, 3 ♀.

**Serica trociformis blatchleyi** new variety.

*Serica trogiformis* Blatchley, Coleoptera of Indiana, p. 958, 1910.

The evidence at hand seems to indicate that the form described by Blatchley as "*trogiformis* Uhler" should be designated as a distinct race. It differs from the type form by the possession of a median groove on the pronotum, which usually expands into a distinct sub-basal impression. Frequently supplementary impressions occur on each side of the median groove just anterior to the middle of the pronotum. Thus a pattern of impressions faintly suggesting the conventional skull, or monkey face is produced. Sometimes one or two faint sublateral impressions also occur. An opaque surface lustre with traces of sericeous iridescence often accompanies the pronotal pattern of impressions. These pronotal modifications are evanescent, the last thing to weaken and fade out is the median groove. However, when seen at their maximum development they present a type strikingly distinct from that described by Burmeister, where the pronotum is shining and evenly convex. The apparent correlation of these pronotal characters with geographical (possibly ecological) distribution makes it desirable to distinguish both forms by name.

No tangible character has been discovered in the genital armature separating the variety *blatchleyi* from typical *trociformis*.

Type: ♂. Sudbury, Mass., C. A. Frost, (U. S. National Museum).

Specimens examined: 108 ♂, 78 ♀: Most of this material has long since been returned to the collections from which it was borrowed. If it could now be re-examined in the light of recent information it is possible that an occasional specimen might be referred to the typical form; however it is believed that the record is essentially correct.

Massachusetts: "Mass.", 11 ♂, 14 ♀; Berkeley, 2 ♀; Bourne, 1 ♀; Dartmouth, 4 ♂, 6 ♀; Dighton, 1 ♂; Fall River, 1 ♂, 1 ♀; Framingham, 9 ♂, 3 ♀; Lexington, 2 ♂, 1 ♀; Lowell, 1 ♀; Natick, 5 ♂, 1 ♀; Sharon, 1 ♀; Springfield, 1 ♂; West Springfield, 1 ♀.

- Rhode Island: "R. I.", 1 ♂; Barrington, 2 ♂, 1 ♀; Spring Green, 1 ♀; Washington, 1 ♀.
- Connecticut: Granby, 1 ♂; Hamden, 3 ♂; Manchester, 8 ♂; New Haven, 6 ♂, 5 ♀; Rainbow, 2 ♂; Westville, 1 ♂.
- New York: New York City, 3 ♂; Karner, 2 ♀; Long Island, 2 ♂, 1 ♀; Plains, Whiteface Mountain, 1 ♀.
- Pennsylvania: "Pa.", 1 ♂; Philadelphia, 1 ♀; Shirleysburg, 1 ♂, 3 ♀.
- New Jersey: "N. J.", 9 ♂, 7 ♀; Buena, 1 ♀; Fort Lee District, 3 ♂, 3 ♀; Jamesburg, 1 ♂; Ocean Co., 1 ♀.
- Maryland: "Md.", 3 ♂, 3 ♀; Bladensburg, 1 ♂; College Park, 1 ♂; Odenton, 1 ♂, 3 ♀.
- District of Columbia: Washington, 5 ♂; Rock Creek, 1 ♂, 1 ♀.
- Virginia: Glencarlyn, 5 ♂, 3 ♀; Mount Vernon, 4 ♂.
- Indiana: Posey Co., 1 ♂ (recorded by Blatchley).
- Kentucky: Louisville, 1 ♀.
- Tennessee: Eastern Tennessee, 2 ♂, 2 ♀ (approaching typical form); Fentress, 4 ♂.
- North Carolina: Asheville, 2 ♂, 4 ♀.
- Missouri: "Mo.", 1 ♀.

### **Serica imitans** Chapin

*Omaloplia trogiformis* Uhler, Proc. Acad. N. S., Phil., vii, p. 415, 1855.

*Serica imitans* Chapin, Proc. Biol. Soc. Washington, 44, p. 5, 1931.

A curious taxonomic confusion is involved in the name for this species. In the same year (1855) both Burmeister and Uhler endeavored to validate the manuscript name *Omaloplia trociformis* Germar. Each had a different, though very similar species. Burmeister called his *trociformis*, and Uhler called his *trogiformis*, (a better spelling). Both names have been used (though Burmeister's has priority) and nobody has suspected that two species were involved. While the writer was debating what to do with the "twin names for twin species," Mr. Chapin discovered Uhler's species and described it as *imitans*.

Since the names *trociformis* and *trogiformis* are clearly of the same origin, meaning and intent we may interpret the case as

coming under Article 35 of the International Code of Zoological Nomenclature, and declare *trogiformis* Uhler a homonym, thus freeing the way for the acceptance of Mr. Chapin's name *imitans*. Such a procedure will avoid the endless confusion that would certainly result from the retention of the twin name *trogiformis*.

The writer is indebted to Mr. Chapin for the male paratype from which the figures on Plate XXXV were drafted. It bears the data "Egg Harbor City, N. J., May, M. Decker, '29," and is being returned for deposition with the holotype in the U. S. National Museum.

Identification of *imitans* is easily made without the aid of the genital armature by the short erect and sparse hair on the pronotum. In this character it begins to approach *iricolor* Say.

Specimens examined: 9 ♂, 9 ♀:

New Jersey: "N. J.", 2 ♂, 3 ♀; Atco, 1 ♂; Buena, 2 ♂; Clementon, 1 ♂, 1 ♀; Da Costa, 3 ♀; Egg Harbor City, 2 ♂, 2 ♀; Lakehurst, 1 ♂.

Maryland: Hyattsville, 1 ♂.

### **Serica iricolor** Say

*Melolontha iricolor* Say, Journ. Acad. N. S. Phil., iii, p. 246, 1824.

*Serica iricolor* Burmeister, Handb. Ent., iv, 2, p. 178, 1855.

*Serica iricolor* Le Conte, Journ. Acad. N. S. Phil., Ser. 2, iii, p. 275, 1856.

*Serica iricolor* Blatchley, Coleoptera of Indiana, pp. 956, 958, 1910.

This is the only species of North American *Serica* upon which there was correct unanimity of opinion prior to the date of employment of the genitalia as an aid to specific determination. Its small size, dark color, iridescence and dense, erect, rusty, pronotal hair sufficed to mark it definitely. For completeness of the record of eastern species the genital armature is here figured (Pl. XXXVI) and the distribution known to the writer recorded. The specimen used for the drawing bears the data "Mass.," may be regarded as a neotype, and is deposited in the U. S. National Museum.

Specimens examined: 135 ♂, 93 ♀:

New Hampshire: "N. H.", 1 ♂; Three Mile Island, 2 ♂, 2 ♀.

Massachusetts: "Mass.", 4 ♂, 3 ♀; Attleboro, 1 ♂; Berkley, 1 ♂; Blue Hill, 1 ♂; Cape Cod, 1 ♀; Fall River, 12 ♂, 5 ♀; Martha's Vineyard, 1 ♀; Wellesley, 2 ♂, 1 ♀; Woods Hole, 1 ♀.

Rhode Island: Lonsdale, 1 ♀.

New York: "N. Y.", 18 ♂, 10 ♀; Ft. Montgomery, 1 ♀; Huntington, 2 ♂, 1 ♀; Ithaca, 20 ♂, 10 ♀; Peekskill, 1 ♀; Port Jefferson, 1 ♂, 2 ♀.

Pennsylvania: "Pa.", 2 ♂, 2 ♀; Bethlehem, 1 ♀; Carlisle Junction, 1 ♀; Lancaster, 2 ♂; Landisburg, 4 ♂, 3 ♀; Rockville, 3 ♂, 1 ♀; South Mts., 1 ♀; Water Gap, 1 ♂.

New Jersey: "N. J.", 5 ♂, 2 ♀; Hewitt, 1 ♂; Husted, 1 ♂; Lakehurst, 11 ♂, 2 ♀; Manchester, 1 ♂; Riverton, 4 ♂, 2 ♀.

Maryland: "Md.", 5 ♂, 10 ♀; Bladensburg, 1 ♂, 4 ♀; Beltsville, 2 ♂, 2 ♀; Hyattsville, 10 ♂, 2 ♀; Odenton, 2 ♀.

District of Columbia: Washington, 3 ♀; Rock Creek Park, 10 ♂, 9 ♀.

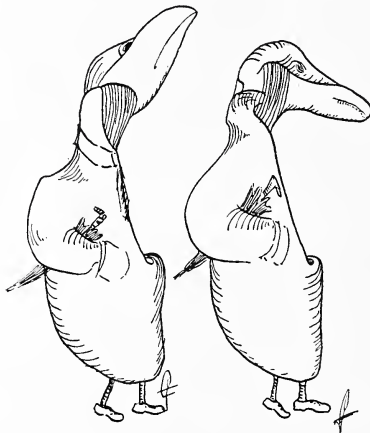
Virginia: Four Mile Run, 1 ♀; Great Falls, 1 ♀; Penington Gap, 1 ♀.

Tennessee: Fentress Co., 1 ♂; Knoxville, 1 ♀.

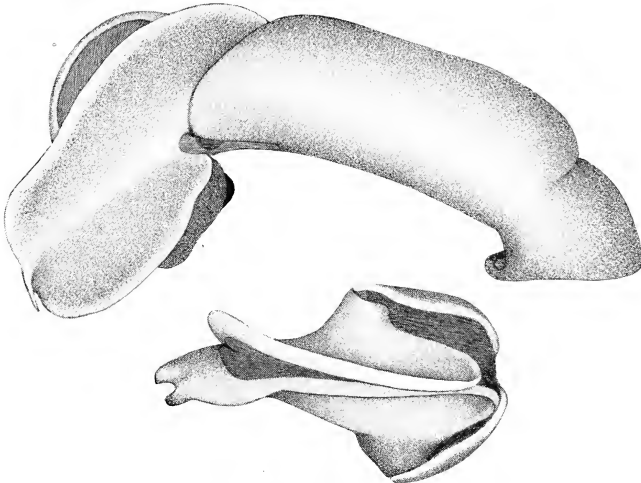
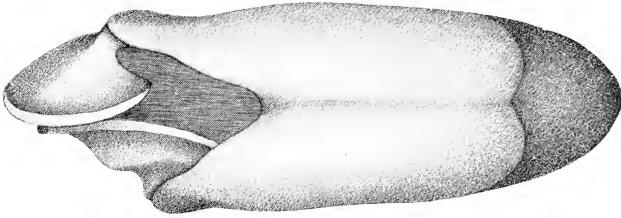
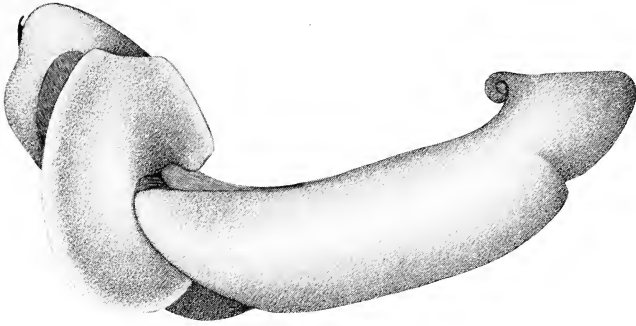
North Carolina: Asheville, 4 ♂, 1 ♀.

Georgia: Gainesville, 1 ♂.

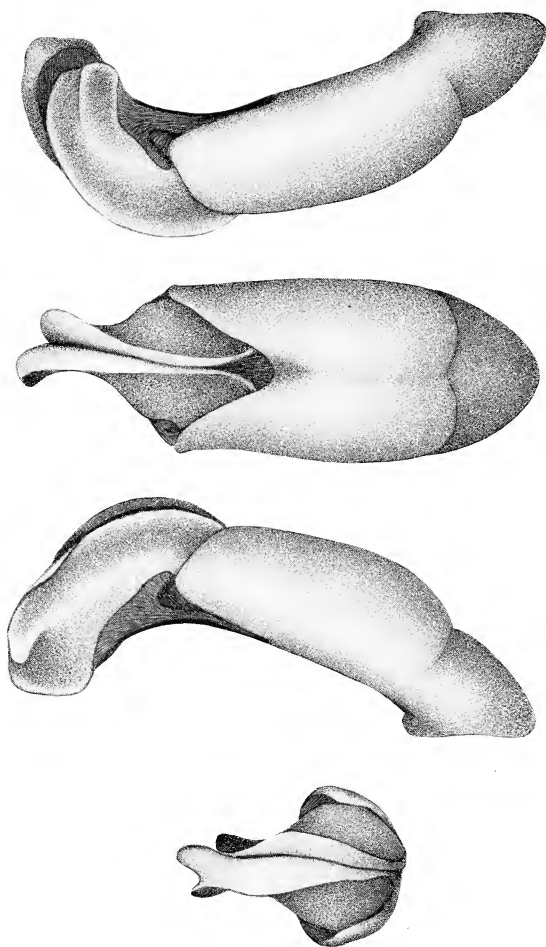
Florida: "Florida," 1 ♂; Key West, 1 ♀.



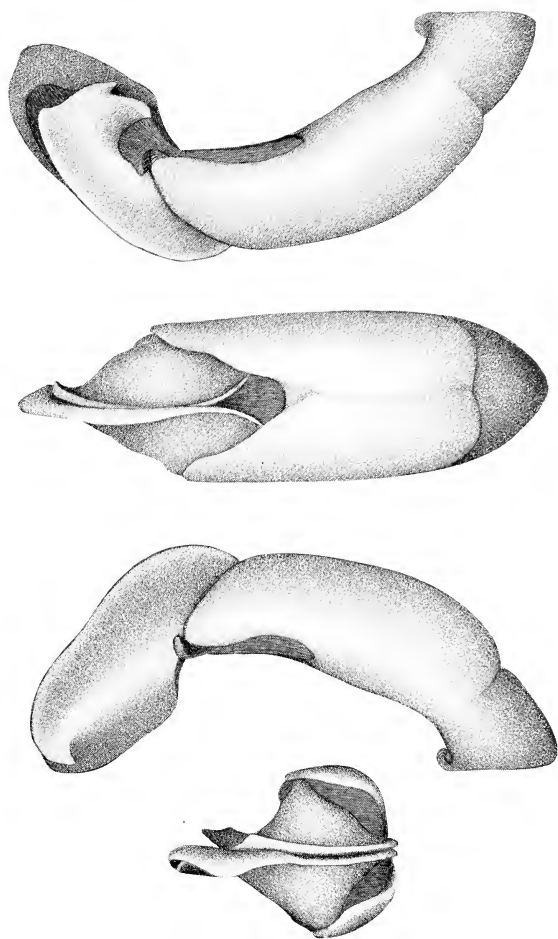




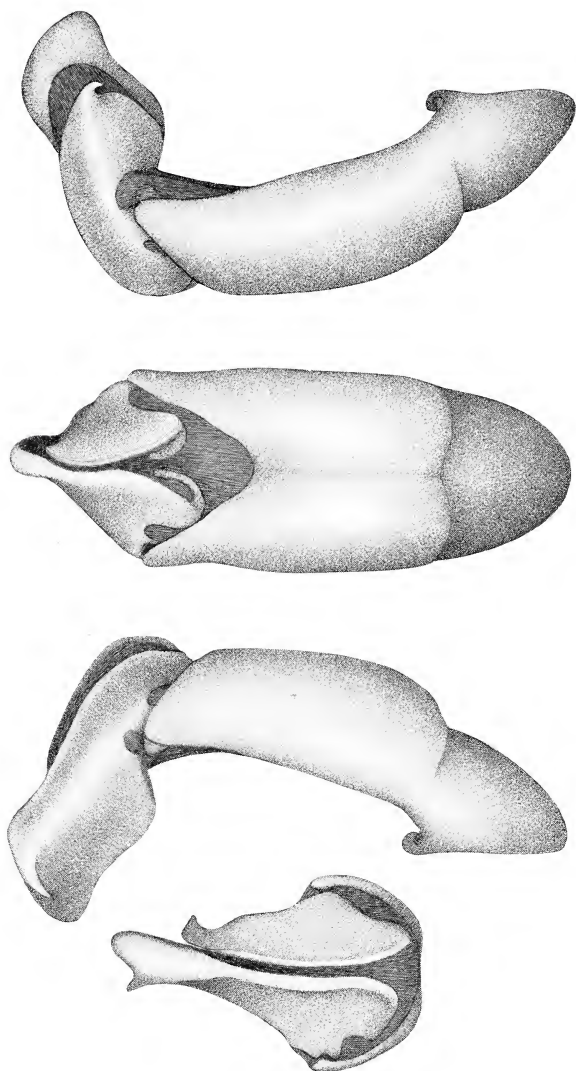
SERICA CHAETOSOMA N. SP.



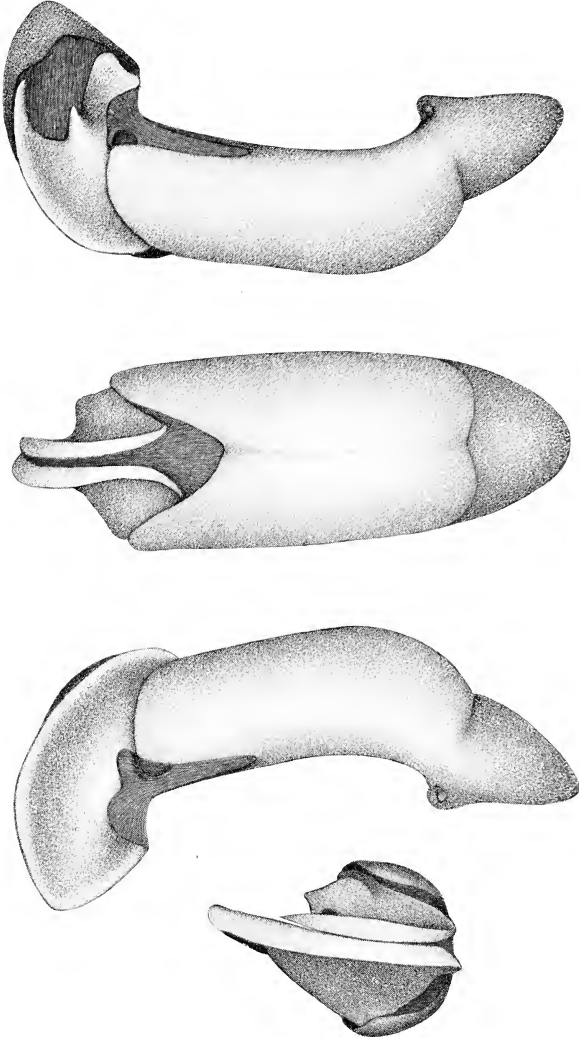
SERICA VENTURA N. SP.



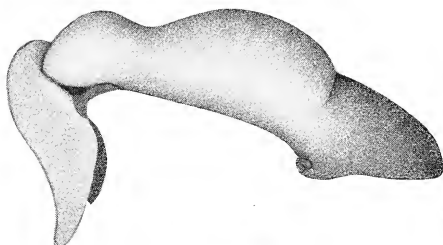
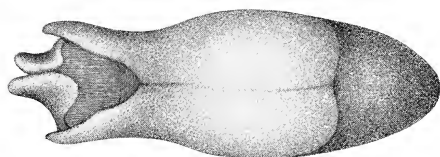
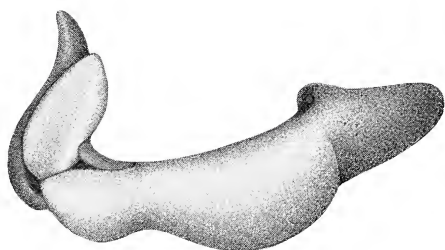
SERICA PERSONATA N. SP.



SERICA CALIGINOSA N. SP.

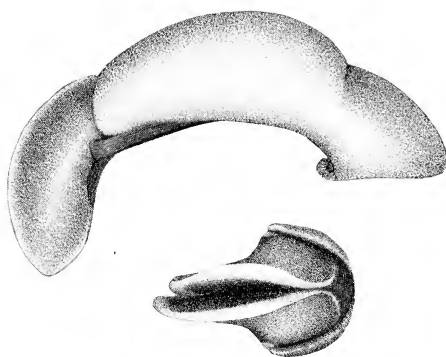
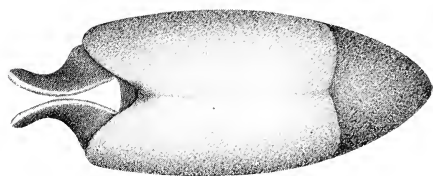


SERICA ACICULA N. SP.

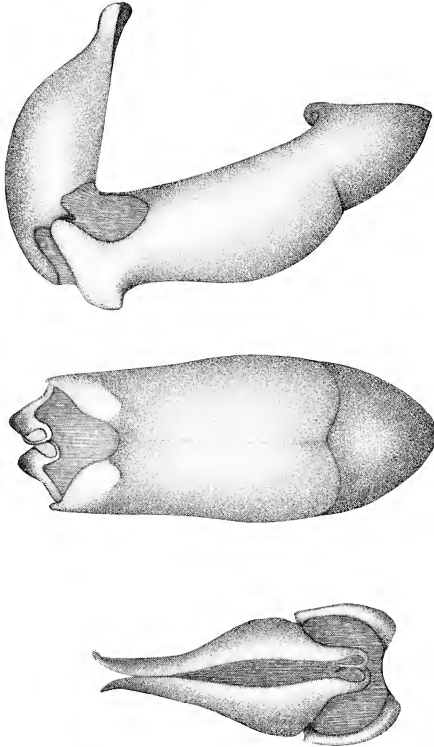


SERICA PAVONIA N. SP.

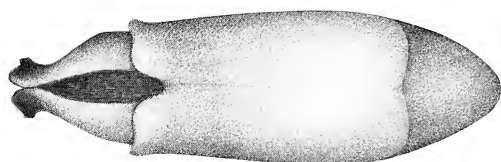
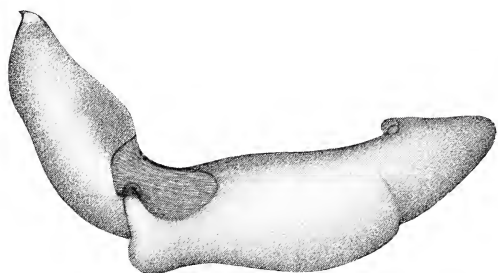




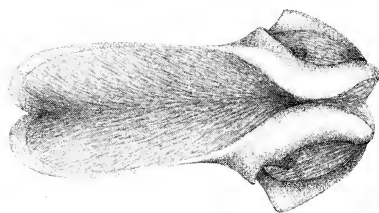
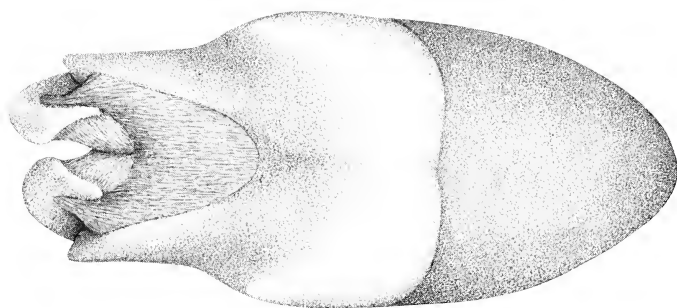
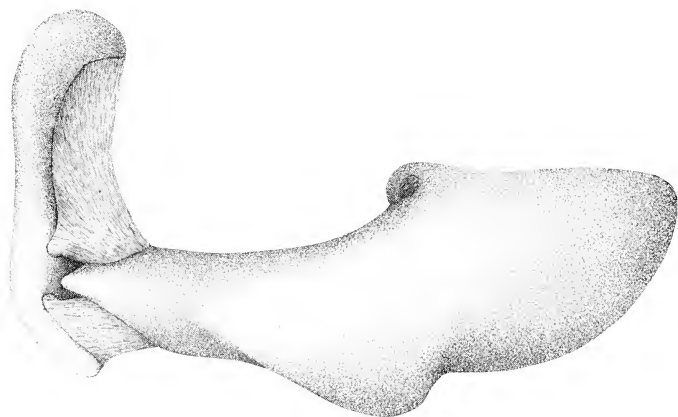
SERICA FALLI N. SP.



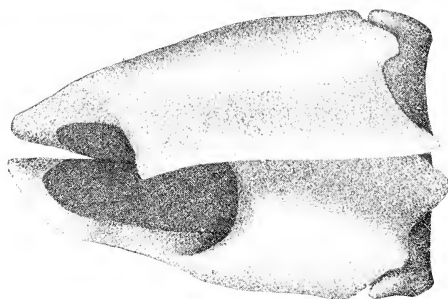
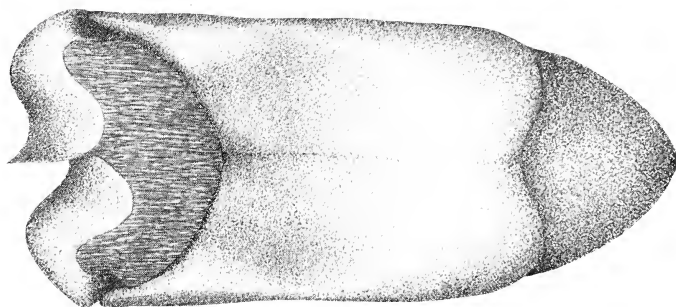
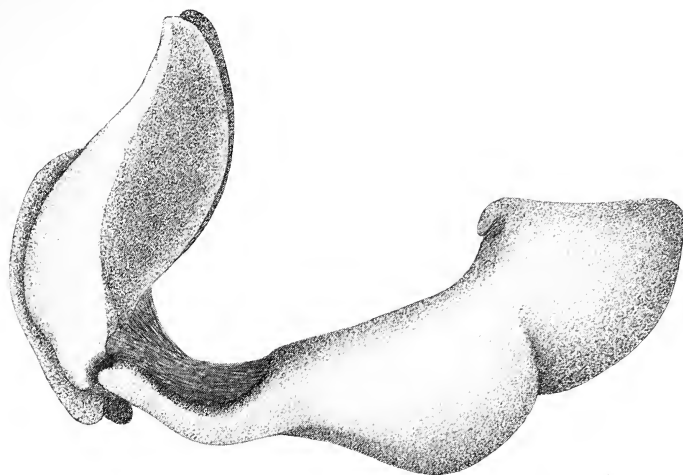
SERICA LIGULATA N. SP.



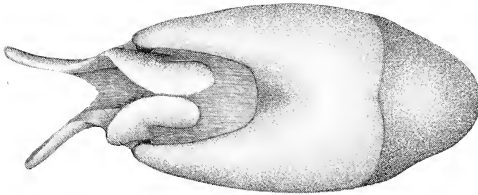
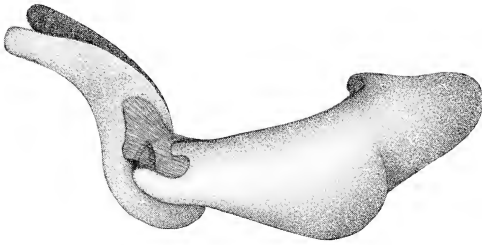
SERICA PRAETERMISSA N. SP.



SERICA GEORGIANA LENG

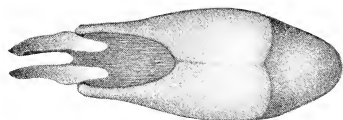
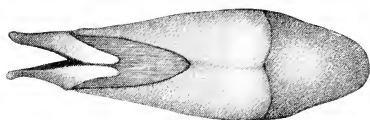


SERICA EVIDENS BLATCHLEY

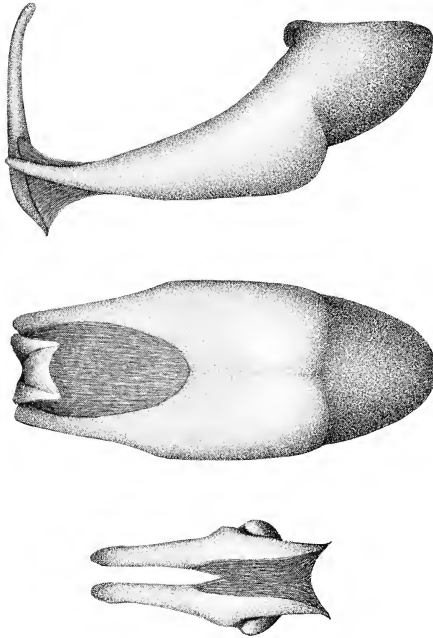


SERICA INTERMIXTA BLATCHLEY





SERICA TROCIFORMIS BURMEISTER  
SERICA IMITANS CHAPIN



SERICA IRICOLOR SAY

## BOOK NOTICE

*Medical Entomology.* BY ROBERT MATHESON, Ph.D. Charles C. Thomas, Springfield, Ill., 1932. xii + 490 pp. 211 fig. Price \$5.00, postpaid.

The science of medicine is usually thought of in connection with chemistry, bacteriology, clinical thermometers and the like and hardly ever in connection with entomology. I venture the guess that many physicians, in our temperate zone at least, are only dimly aware of the part that some insects play as carriers of disease. On the other hand, we have some over-zealous medical entomologists who magnify the disease-carrying possibilities of certain insects upon the basis of rather flimsy evidence, when as a matter of fact, the insects in question are no more important in the spread of human diseases than are door knobs and paper money. And when it comes to emphasizing loss of sleep, loss of blood, and nervous reactions due to the activities of certain insects, such results are caused infinitely more often by non-entomological agencies and in many cases require no more medical attention than baldness. Medical entomology certainly has a better excuse for existing, than the alleviation of minor inconveniences. This may seem like a carping introduction to Dr. Matheson's book, but it should not be taken as such, for I am only relieving myself of some opinions in general.

Dr. Matheson's *Medical Entomology* is a well written, concise and well organized account of arthropods and human diseases. In this book, the student will find a brief historical account of the more important investigators and their work. Following this, the author plunges at once into the main subjects, Acarina and Hexapoda. Keys are given for the separation of groups. Morphology, biology and distribution are discussed, then the members of the groups in their relation to diseases, and finally methods of control. At the end of each chapter numerous references are cited so that the student may be able, if desirable, to refer to more detailed information. As is to be expected, the bulk of the book is devoted to insects and of these the Diptera

occupy a relatively large space. The last two chapters are devoted to poisonous and urticating arthropods and to methods of collecting and preserving insects. Adequate author and subject indexes are provided. The illustrations are good, many of them apparently having been prepared especially for the book. It would be possible to be specific about certain species of which Dr. Matheson has written, but this would only be useless repetition. Dr. Matheson's entomological abilities are well recognized and he has produced a book which may be unhesitatingly recommended as a text wherever medical entomology is taught. Being a Thomas book, the physical qualities are, of course, satisfactory.—Harry B. Weiss.

# INDEX TO NAMES OF INSECTS AND PLANTS IN VOLUME XL

Generic names begin with capital letters. New genera, subgenera, species, subspecies, varieties and new names are printed in italics.

- Abrostola
  - ovalis, 387
- Acanthomyops
  - brunneus, 378
- Acartauchenius
  - insanus, 398
  - texanus, 409
- Aceronyeta
  - leporina
    - vulpina, 387
- Aderocharis
  - corticinus, 78
- Adichosiops*, 441
- Aegialia
  - conferta, 183
  - convexa*, 183
- Agromyza
  - parvicornis, 86
- Aenoplex
  - betulæcola, 492
- Africodexia*, 462
- Africomusca*, 441
- Agonopteryx
  - canella, 386
  - lythrella, 386
- Alabama
  - argillacea, 268
- Anchon
  - aries, 212
  - bilineatus, 212
  - decoratum, 213
  - dschagga, 213
  - flavipes, 213
  - gracilis, 213
  - gunni, 212
  - limbatum, 213
  - minor, 213
  - nodicornis, 213
  - proximus, 213
- senegalensis, 213
- vicinus, 213
- Anthomyia
  - compuncta, 29, 30, 31, 157
  - narina, 105
  - narona, 38
  - prominula, 39
  - triangula, 45
- Anthomyza
  - leucogaster, 131
  - triangulifera, 123
  - tristiola, 123
- Amaranthus
  - retroflexus, 503
- Ambrosia
  - trifida, 503
- Amitrochaetes
  - grahami, 219
- Amphitropesa*, 463
- elegans*, 464
- Anæudora*, 468
- aureocephala*, 468
- Anamastax*, 473
- australis*, 473
- Anax
  - junius, 273
- Antillæmyrmex
  - floridanus, 11
- Apanteles
  - harti, 509
- Apantesis
  - nais, 167, 169, 180
  - virguncula, 387
- Aphænogaster
  - fulva, 4
  - lamellidens, 5
  - mariaë, 5
  - texana, 5
  - miamiana*, 5

- nana*, 6  
*silvestrii*, 5  
*treata*  
  *ashmeadi*, 6
- Aphodius  
  *claudus*, 188  
  *crenicollis*, 189  
  *distinctus*, 79  
  *erraticus*, 79  
  *finetarius*, 79  
  *fortunus*, 187  
  *fossor*, 79  
  *granarius*, 79  
  *incommunis*, 186  
  *inutilis*, 185  
  *longitarsis*, 184  
  *parcus*, 184  
  *ruficlarus*, 189  
  *stercorosus*, 79  
  *terminalis*, 79  
  *testaceiventris*, 185
- Apostrophusia*, 454
- Argyresthia  
  *conjugella*, 386
- Argyrophylacoides*, 477
- Aricia  
  *aerea*, 137  
  *almquistii*, 120  
  *carbonella*, 140  
  *conspurcata*, 108  
  *contractifrons*, 320  
  *denudata*, 136  
  *dorsata*, 107  
  *fuliginosa*, 108  
  *fumipennis*, 311  
  *hyperborea*, 107  
  *illota*, 108  
  *labiosa*, 107  
  *leucogaster*, 131  
  *ludibunda*, 125  
  *megastoma*, 107, 125  
  *nigriventris*, 147  
  *pauxilla*, 125  
  *ranunculi*, 136  
  *rotundiventris*, 137  
  *surda*, 295
- triangula*, 45  
  *triangulifera*, 124, 125  
  *tristiola*, 124  
  *vitticollis*, 124
- Aristotelia  
  *diolcella*, 427  
  *fungivorella*, 431  
  *intermediella*, 430  
  *pudibundella*, 428  
  *roseosuffusella*, 431  
  *rubidella*, 427  
  *salicifungiella*, 431  
  *vagabundella*, 429
- Arthryciopsis*, 468
- Atænius  
  *cognatus*, 79
- Atteva  
  *punetella*, 98
- Austrophasiopsis*, 448  
  *formosensis*, 449
- Autographa  
  *biloba*, 387
- Autoserica  
  *castanea*, 380
- Awania  
  *bigibbosa*, 221  
  *typica*, 221  
  *vicina*, 221
- Barsumas  
  *primus*, 220
- Bassus  
  *simillimus*, 509
- Batrisodes  
  *delaportei*, 378  
  *globosus*, 377
- Bedellia  
  *somnulentella*, 385
- Belonchus  
  *formosus*, 78
- Bidens  
  *cernua*, 503  
  *connata*, 503  
  *frondosa*, 503  
  *vulgata*, 503



- Borborus  
     equinus, 85  
 Botanobia  
     frit, 86, 87  
 Brachymyrmex  
     neeri, 13  
 Bucephalomyia  
     femorata, 50  
 Byrrhus  
     americanus, 79  
  
 Calliphora  
     erythrocephala, 84, 86  
 Camponotus  
     abdominalis, 15  
     caryæ, 15  
         rasis, 15  
         pavidus, 15  
     castaneus, 13  
         americanus, 13  
     herculeanus, 13  
     impressus, 16  
     incensus, 14  
     pennsylvanicus, 377  
     planatus, 15  
     pylartes, 16  
     socius, 14  
         osceola, 15  
     tortuganus, 13  
 Camptorhina  
     atracapilla, 542  
 Caracladus  
     gigas, 395  
 Carausius  
     morosus, 172  
 Cardiocondyla  
     emeryi, 7  
     nuda, 7  
     wroughtonia, 7  
 Celerio  
     euphorbia, 168  
 Centrotus  
     bantuanus, 216  
     bovinus, 216  
     difficilis, 216  
     flagillifer, 215  
     laxatus, 216  
     quadripunctatus, 216  
     rugosus, 216  
     serpentarius, 215  
     shoanus, 216  
     subnodosus, 216  
     varipennis, 216  
 Centrotusoides  
     muiri, 218  
     weali, 218  
 Centruchus  
     capensis, 227  
     fuscipennis, 227  
     villosus, 228  
 Cereyon  
     prætextatus, 78  
     pygmæus, 78  
 Cerodontha  
     dorsalis, 86  
*Chaetanicia*, 445  
     sautei, 446  
 Chætopsis  
     fulvifrons, 85  
 Chenopodium  
     album, 503  
*Chlorolydella*, 473  
     caffrariæ, 474  
*Chlorophryno*, 478  
 Chlorops  
     obscuricornis, 85  
*Chlorrhynchomyia*, 440  
     clausa, 440  
 Chrysopeleia  
     ostryæella, 386  
     purpurella, 386  
 Chrysops  
     niger, 83  
*Chrysopygia*, 471  
     auricaudata, 472  
*Chrysosarcophaga*, 441  
     superba, 442  
 Cicada  
     chisos, 250  
 Cicindela  
     albertina, 353  
     amœna, 347

- ardelio, 350  
auduboni, 347  
awemeana, 347  
cimarrona, 353  
conquisita, 352  
decemnotata, 353  
discus, 350  
eldorensis, 347  
franciscana, 346  
graminea, 346, 352  
inducta, 350  
lantzi, 353  
lauta, 346  
limbalis, 347  
    auguralis, 350  
    spreta, 349  
    transversa, 348  
marginalis, 345  
militaris, 347  
mirabilis, 346  
omœna, 351  
oreada, 352  
purpurea, 269, 345  
    auduboni, 346  
    nigerrima, 347  
splendida, 347, 350  
    cyanocephala, 351  
    denverensis, 352  
    ludoviciana, 351  
    propinqua, 352  
    pugetana, 353  
spreta, 345  
tanneri, 354  
Cladium  
    effusum, 13  
Cnephasia  
    argentana, 386  
    listerana, 386  
Cocoloba  
    uvifera, 4  
Cœnosia  
    flavicoxa, 85  
    lata, 85  
    rufitibia, 85  
    triangula, 45  
Colias  
    eurytheme, 273  
    philodice, 273  
Coloborrhis  
    corticina, 205  
    perspicillaris, 205  
Congellana  
    electa, 228  
    leighi, 228  
    strigata, 228  
Cornus  
    paniculata, 386  
Cotalpa  
    leonina, 203  
Crematogaster  
    ashmeadi, 7  
    matura, 8  
    atkinsoni, 8  
    helveola, 9  
    lineolata, 9  
    pilosa, 9  
    lineolatus, 377  
    minutissima, 9  
Cryptocerus  
    varians, 11  
Culex  
    quinquetans, 277  
Cyanomyia  
    cadaverina, 84  
Cymolomia  
    cornana, 386  
Cymomyia  
    cadaverina, 86  
Cyphomyrmex  
    rimosus, 11  
Dacaratha  
    nyasana, 226  
Dasylophia  
    thyatiroides, 387  
Demanga  
    deflectens, 221  
    occidentalis, 221  
Dermatobia  
    hominis, 277

- Diceroprocta  
   apache, 247  
   bequaerti, 249  
   biconica, 245  
   bonhotei, 245  
   cinctifera  
     *limpia*, 246  
   cleavesi, 246  
   eugraphica, 248  
   swalei  
     castanea, 249  
 Dinera  
   futilis, 84  
 Diplotaxis  
   *deserta*, 196  
   *futilis*, 194  
   *incuria*, 196  
   *mus*, 192  
   *pinalica*, 196  
   *producta*, 195  
   *protensa*, 193  
   *villosipes*, 193  
   *versicolor*, 85  
 Discochæta, 479  
   *braueri*, 479  
 Doleschalopsis, 459  
 Dolichoderus  
   plagiatus, 12  
   pustulatus, 12  
 Dorymyrmex  
   pyramicus, 12  
 Dynamis  
   borassi, 277  
 Earias  
   ehlorana, 168, 177  
 Eelimus  
   muricatus, 435  
 Ectatosticta  
   australis, 20  
   troglodytes, 20  
 Ection  
   opacithorax, 2  
   schmitti, 2  
 Engelobogosa, 449  
 Eodolichocolon, 478  
 Eperigone  
   tridentata, 393  
 Epibates  
   muricatus, 435  
 Epiblema  
   otiosana, 503, 505, 507  
 Epinotia  
   lindana, 386  
 Epiuris  
   pterophori, 509  
 Erebus  
   odora, 268  
 Erichomus  
   ventriculus, 79  
 Erigone  
   ornata, 403  
   pictilis, 393  
 Erigonoplus  
   gigas, 395  
 Eriphia  
   biquadrata, 47  
 Eristalis  
   broussii, 273  
 Eucatoptus  
   rubidella, 427  
 Eudioptis  
   nitidalis, 98  
 Eugymnopeza, 453  
   *braueri*, 453  
 Euhybos  
   triplex, 84  
 Eulimnophora  
   arcuata, 55  
   cilifera, 55  
   dorsovittata, 54  
 Eumetopiops, 445  
 Eumiltogramma, 443  
   *angustifrons*, 444  
 Eumonocentrus  
   bifureus, 209  
   erectus, 209  
   lamborni, 209  
 Euponera  
   stigma, 3

- Eupseudosarcophaga*, 442
- Eurymus  
eurytheme, 510
- Euxiphopæus  
geniculatus, 223  
hireulus, 223
- Evanchon  
minutus, 219
- Everestiomysia*, 466  
antennalis, 466
- Exptochiomera  
arizonensis, 359, 363  
formosa, 363  
fuscicornis, 362  
intercisa, 357, 358, 363  
minima, 463  
nana, 361, 362  
oblonga, 363
- Fannia  
canicularis, 85, 86  
serena, 85
- Formica  
pallide-fulva, 17  
schaufussi, 17
- Formicocyptera*, 451
- Formosodoria*, 475
- Gargara  
addahensis, 206  
ænea, 207  
asperula, 206  
aterrima, 206  
fraterna, 207  
makalakæ, 206  
nyanzai, 206  
perpolita, 206  
variegata, 206
- Gelechia  
intermediella, 430  
modestella, 430  
pudibundella, 428, 429  
rubensella, 430  
rubidella, 427
- Glischrochilus  
fasciatus, 79
- Glutops  
singularis, 267
- Glyphipteryx  
saurodonta, 386
- Glypta  
rufiscutellaris, 493
- Gonanamastax*, 472
- Gonglydium  
kincaidi, 400
- Gongroneura  
brevicornis, 229  
confusa, 229  
delalandei, 230  
ornata, 230  
triste, 230
- Grammonota  
bidentata, 394  
capitata, 394  
electa, 394  
fratrella, 394  
gigas, 395  
inornata, 397  
insana, 398  
inusiata, 399  
kincaidi, 400  
letourneuxi, 394  
maculata, 401  
maritima, 402  
obesior, 394  
orites, 394  
ornata, 403  
pallipes, 405  
pictilis, 406  
semipallida, 408  
simplex, 394  
spinimana, 408  
texana, 409  
trivittata, 411  
venusta, 393  
vittata, 412
- Gryllus  
domesticus, 267
- Gyrophypnus  
hamatus, 78  
obsidanus, 78
- Gyrovaga*, 473

- Habrosyne  
   rectangula, 387  
 Halietus  
   asperithorax, 520  
   bassi, 521  
   baudini, 521  
   blighi, 521  
   boweni, 521  
   *darwinicellus*, 519  
   gilesi, 520  
   granulithorax, 520  
   griseovittatus, 520  
   isthmalis, 521  
   oblitus, 520  
   repertus, 519, 520  
   repræsentans, 520  
   supralucens, 520  
 Hamma  
   mabirensis, 209  
   nodosum, 209  
 Hamumomyia  
   johnsoni, 85  
 Hebeenema  
   umbratica, 84  
*Hecatæpalpus*, 467  
 Helicobia  
   helicis, 84  
 Heliothus  
   obsoleta, 268  
 Hippelates  
   flavipes, 26, 87  
   pusio, 86  
   subvittatus, 86  
*Hippoæstrus*, 447  
 Hister  
   americanus, 79  
   curtatus, 79  
 Hyetodesia  
   dorsata, 108  
 Hipocrita  
   jacobacæ, 168  
 Hylemyia  
   antiqua, 85  
   cilicrura, 85  
   cinerella, 85, 86  
 Hyloicus  
   merops  
     *judsoni*, 375  
   monjena, 375  
 Hypochilus  
   davidi, 20  
 Incurvaria  
   russatella, 385  
*Innshanotroxis*, 466  
   *engeli*, 467  
 Iridomyrmex  
   pruinosis, 12  
 Juglans  
   cinerea, 497  
 Kombazana  
   fidelis, 208  
 Laphyma  
   frugiperda, 268  
 Lasius  
   brevicornis, 17  
   claviger, 17  
   niger  
     alienus  
       americanus, 16, 377  
 Latrodectus  
   geometricus, 23  
 Leptocentrus  
   altifrons, 223  
   arebiensis, 224  
   aureomaculatus, 223  
   australis, 225  
   confusus, 225  
   grossus, 224  
   lama, 223  
   limbipennis, 224  
   montanus, 223  
   peracatus, 224  
   rufipennis, 224  
   thelwalli, 223  
   ugandensis, 224  
 Leptocera  
   frontinalis, 85, 86

- longicosta, 85, 86  
ordinaria, 85, 86  
Leptogenys  
  elongata, 3  
Leptothorax  
  floridanus, 11  
Leucomelina  
  discreta, 41  
  pica, 37  
Ligyrocoris  
  intercisus, 359  
Limnophora  
  acuticornis, 294  
  addicta, 133  
  æquifrons, 33, 50  
  ærea, 137  
  alberta, 143  
  alliterata, 280  
  almquistii, 120  
  alticola, 312  
  angulata, 120  
  anthrax, 314  
  arctica, 125  
  arcuata, 33, 53, 55  
  arenosa, 148  
  argenteiceps, 297  
  argentiventris, 150  
    var. *occidentalis*, 150  
  baltica, 308  
  biquadrata, 47  
  bisetosa, 300  
    *pruinella*, 302  
  brevicornis, 287  
  cana, 299  
  carbonella, 140  
  caroli, 297  
  cilifera, 55  
  clarans, 298  
  elivicola, 318  
  comata, 146  
  compuncta, 157, 279  
  concolor, 130  
  conspurecata, 108  
  contractifrons, 136  
    fumipennis, 311  
  crassiventris, 292  
    *crepusculenta*, 144  
    *cretans*, 151  
  cyrtoneurina, 39  
  debilis, 54  
  denudata, 136  
  dentata, 39  
  discreta, 40  
  dorsata, 125  
  extensa, 126  
  *fatima*, 127  
  femorata, 49  
  *fimbriata*, 305  
  frigida, 108  
  fuliginosa, 108  
  fumipennis, 308  
  fumosa, 316  
  *fuscomarginata*, 290  
  gibsoni, 310  
  groenlandica, 42  
  hyperborea, 107, 108  
  illota, 108  
  imitatrix, 284  
  incauta, 288  
  incrassata, 41  
  instans, 116  
  kincaidi, 49  
  leucogaster, 131  
  litorea, 320  
  ludibunda, 125  
  magnipunctata, 315  
  megastoma, 122, 125  
  *melanosoma*, 110  
  monacantha, 114  
  monticola, 148  
  narina, 105  
  narona, 38  
  nigrifrons, 105  
  nigripes, 44  
  nigriventris, 147  
  nitidifrons, 319  
  nobilis, 142  
  novæ-angliæ, 111  
  nupta, 320  
  obsoleta, 109  
  obseuripennis, 132  
  parvimaculata, 318



- pauxilla, 125  
 pearyi, 108  
*placida*, 154  
 pluvialis, 306  
 prominula, 39  
*pulchra*, 313  
*pulvicrura*, 138  
*pusilla*, 134  
 ranunculi, 136  
*reflecta*, 316  
 refusa, 321  
 rostrata, 120  
 ruftarsis, 153  
 ruftibia, 303  
 sanctipauli, 122  
*sectata*, 112  
 semiglobosa, 118  
*setiamellata*, 118  
*setinervis*, VEE  
 sinuata, 320  
*sospita*, 115  
 squamosa, 315  
 stygia, 321  
 subrostrata, 107  
 surda, 295  
 syspecta, 304  
 tendipes, 120  
 tetrachæta, 130  
 torreyæ, 292  
 triangula, 45  
 triangulifera, 124  
*trilineata*, 283  
 tristiola, 123, 124  
 umbrina, 292  
 velutina, 105  
 vitticollis, 124  
 Limosia  
   nigripes, 44  
 Lispoides  
   æquifrons, 51  
 Listrochelus  
   *juvenilis*, 200  
   *plenus*, 199  
 Lithocolletis  
   cratægella, 386  
   ostensackenella, 386  
 Lixophaga  
   variabilis, 509  
 Lonchoptera  
   furcata, 84  
 Lucanus  
   elephas, 271  
 Lucilia  
   sericata, 84, 86  
*Lydellina*  
   *villeneuvei*, 469  
 Lymantria  
   dispar, 276  
 Macronoctua  
   onusta, 509  
*Macropodexia*, 462  
*Macrosophia*, 459  
   *papua*, 460  
 Malacosoma  
   americana, 481  
*Malaïocrocota*, 479  
 Masicera  
   senilis, 509  
*Megistodexia*, 456  
   *diaristata*, 456  
 Melanochelia  
   acuticornis, 294  
   alticola, 312  
   angulata, 121  
   anthrax, 315  
   argentiventris, 150  
   brevicornis, 287  
   caroli, 297  
   clivicola, 318  
   extensa, 126  
   gibsoni, 310  
   hirticauda, 109  
   imitatrix, 284  
   immaculiventris, 321  
   magnipunctata, 316  
   monticola, 148  
   novæ-angelæ, 111  
   obsoleta, 109  
   pearyi, 108  
   sanctipauli, 122  
   spinicosta, 320

- suspecta, 304  
 tetrachæta, 130  
 torreyæ, 292  
 velutina, 105  
*Melanojeania*, 465  
*Melicharella*  
   albipennis, 220  
   montana, 220  
*Melontha*  
   iricolor, 547  
*Meroplus*  
   stercorarius, 85, 86  
*Metachæta*  
   helymus, 84  
*Microbracon*  
   caulicola, 509  
   lutus, 509  
*Molliopsis*, 470  
*Monocentrus*  
   albomaculatus, 212  
   bipennis, 211  
   deletus, 211  
   fuscum, 211  
   hyalinipennis, 211  
   laticornis, 211  
   opacus, 211  
*Monomorium*  
   floricola, 9  
   minimum, 9  
   pharaonis, 10  
*Morpho*  
   peleides  
     insularis, 523  
*Musca*  
   ærea, 137  
   domestica, 84, 86  
   lauta, 439  
   notata, 37  
   triangula, 45  
*Muscina*  
   stabulans, 84, 86, 509  
*Myiospilia*  
   meditabunda, 84  
*Myrmecina*  
   graminicola, 11  
*Necrophorus*, 391  
*Negus*  
   asper, 229  
*Nemopoda*  
   cylindrica, 85  
*Neobisnius*  
   sobrinus, 78  
*Neoclæon*, 365  
   alamance, 365, 367  
*Neoharmonia*  
   venusta, 267  
*Neuroplagia*, 479  
*Nicrophorus*, 391  
*Noctua*  
   phyllophora, 387  
*Nomia*  
   eboracina, 521  
   frieseana, 522  
   testacea, 521  
*Obrussa*  
   ochrefasciella, 385  
*Ochthiphilia*  
   polystigma, 85  
*Odontomachus*  
   hæmatoda  
     insularis, 3  
*Odontomyia*  
   alticola, 437  
   nuda, 436  
   similis, 435  
*Oedothorax*  
   kincaidi, 400  
*Oestrosomomyia*, 443  
*Okanagana*  
   bella, 253  
   californica, 254  
   fumipennis, 251  
   nigrodorsata, 253  
   rubrovenosa, 253  
   schaefferi  
     tanneri, 250  
   utahensis, 254  
   vanduzeei  
     consobrina, 254  
   viridis, 253

- Okanagodes  
     *gracilis*  
         *pallida*, 256  
     *terlingua*, 257
- Olene  
     *pini*, 387
- Olethreutes  
     *duplex*, 386  
     *hebesana*, 386  
     *malachitana*, 386
- Olophrum  
     *obtectum*, 78
- Omaloplia  
     *trogiformis*, 546
- Onthophagus  
     *hecate*, 79  
     *pennsylvanicus*, 79
- Ophyra  
     *leucostoma*, 84
- Orientodoria*, 477
- Otinotus  
     *arcuatus*, 227  
     *curvidens*, 227  
     *griseus*, 226  
     *nigrorufus*, 227  
     *pilosus*, 227  
     *recurvus*, 227
- Oxyrhachis  
     *bisenta*, 233  
     *caudatus*, 233  
     *delalandei*, 233  
     *egyptianus*, 233  
     *gambiae*, 233  
     *gibbulus*, 233  
     *labatus*, 234  
     *lamborni*, 232  
     *nigropietus*, 233  
     *pandatus*, 233  
     *subserratus*, 233  
     *tarandus*, 232  
     *tenebrosus*, 233
- Oxytelus  
     *insignitus*, 78
- Pæderus  
     *littorarius*, 78
- Papaipema  
     *nebris*, 509
- Papilio  
     *hospitans*, 267
- Parafeburia*, 446
- Paralimnophora  
     *brunnesquama*, 105  
     *velutina*, 105
- Parallelomma  
     *pleuritica*, 85
- Paraphryno*, 469
- Paraphypenodes  
     *quadralis*, 387
- Paratrechina  
     *bourbonica*, 16  
     *longicornis*, 16  
     *paravula*, 16  
     *vividula*, 16
- Paraxiphopæus  
     *arebiensis*, 210  
     *gestroi*, 210  
     *nodosus*, 210  
     *schubotzi*, 210
- Phænonotum  
     *estriatum*, 78
- Phasioormia*, 447  
     *pallida*, 448
- Pheidole  
     *commutata*, 6  
     *dentata*, 6  
     *floridana*, 6  
     *metallesceus*, 7  
     *morrisi*, 7
- Philonome  
     *clemensella*, 385
- Philonthus  
     *brunneus*, 78  
     *eunetans*, 78  
     *discoideus*, 78  
     *micans*, 78
- Philotrichostylum*, 460
- Phyciodes  
     *batesii*, 387
- Phyllophaga  
     *contaminata*, 197  
     *extranea*, 198

- Pieris  
  rapæ, 168
- Planecornua  
  infractus, 215
- Platybelus  
  africanus, 219  
  albescens, 218  
  escaleranus, 218  
  flavus, 219  
  gowdeyi, 219  
  insignis, 219  
  sinuosus, 218
- Platypedia  
  mohavensis  
    *rufescens*, 258  
  rufipes  
    *angustipennis*, 260  
    *bernardinænsis*, 259
- Plutella  
  porrectella, 386
- Pogonomyrmex  
  badius, 2, 4
- Polychrosis  
  yaracana, 386
- Ponera  
  coarctata, 3  
  opaciceps, 3  
  trigona  
    opacior, 3
- Populus  
  tremuloides, 386
- Prenolepis  
  imparis  
    *testamea*, 16
- Preuthera*, 452
- Pristomerus  
  ocellatus, 492
- Prodenia  
  ornithogolli, 268
- Prodexilla*, 461  
  *petiolata*, 462
- Prophypotachina*, 464  
  *rutilioides*, 465
- Protophoshia*, 450  
  *petiolata*, 450
- Promitor  
  nominatus, 208
- Psammobius  
  *armaticeps*, 190  
  *blandus*, 191  
  *mimeticus*, 192
- Pseudolimnophora  
  nigripes, 44  
  rotundata, 320  
  triangula, 46
- Pseudolucanus  
  capreolus, 271
- Pseudominthodes*, 455  
  *scutellaris*, 455
- Pseudomyrma  
  brunnea, 3  
  elongata, 4  
  flavidula, 4  
  pallida, 4
- Psilocephala  
  hæmorrhoidalis, 83
- Psychoda  
  minuta, 83
- Pyrausta  
  nubilalis, 509
- Pyrgus  
  tessellata, 267
- Quedius  
  capucinus, 79  
  molechinus, 79
- Reepenina  
  eborcina, 522  
  testacea, 521
- Rhagoletis  
  suavis, 497
- Rhamphomyia  
  mutabilis, 84
- Rhinomydes*, 474  
  *emporomyioides*, 474
- Rhyncoporus  
  palmarium, 277
- Rutilotrix*, 448
- Sarcophaga  
  assidua, 84  
  bisetosa, 84  
  cimbicis, 84, 509

- communis, 84
- sinuata, 84
- Scatophaga
  - furcata, 85
  - stercoraria, 85
- Scatopse
  - notata, 83
- Scepsis
  - fulvicollis, 272
- Schænomyza
  - chrysotoma, 85
- Scutellorthellia*, 439
- Semiosecpis
  - aurella, 386
- Sepedon
  - pusillus, 85
- Sepsis
  - signifera
    - curvittibia, 85
  - violacea, 85, 86
- Sequas
  - elevartus, 268
- Serica
  - acicula*, 533
  - atricapilla*, 542
  - brunnea*, 382
  - caliginosa*, 532
  - chætosoma*, 529
  - cucullata*, 543
  - evidens*, 539
  - falli*, 534
  - georgiana*, 536
  - imitans*, 546
  - intermixta*, 540
  - iricolor*, 547
  - ligulata*, 535
  - parallela*, 381
  - pavonia*, 533
  - personata*, 531
  - prætermissa*, 536
  - pusilla*
    - errans, 538
  - serica*, 380
  - sericea*, 542
  - similis*, 381
  - trociformis*, 544
    - blatchleyi, 545
  - trogiformis*, 379
  - ventura*, 530
- Sericophoromyiops*, 470
- Solenobia
  - walshella, 385
- Solenopsis
  - geminata*, 10
  - læviceps*, 10
  - picta*, 10
- Spalirises
  - alticornis*, 214
  - humilis*, 215
  - rugosa*, 214
- Sphæridium
  - bipustulatum*, 78
  - scarabæoides*, 78
- Sphærocera
  - subsaltans*, 85, 86
- Sphecius
  - convallis*, 248
- Sphenomyia
  - banffi*, 47
  - kincaidi*, 49
- Spilogaster
  - narina*, 105
  - nigrinervis*, 140
- Spilogona
  - acuticornis*, 294
  - ærea*, 137
  - alpica*, 320
  - alticola*, 312
  - arcuata*, 55
  - argenteiceps*, 297
  - carbonella*, 140
  - caroli*, 297
  - clivicola*, 318
  - defflorata*, 320
  - freyi*, 320
  - latilamina*, 320
  - leucogaster*, 33
  - macropyga*, 320
  - magnipunctata*, 316
  - malaisei*, 320
  - micans*, 320
  - monticola*, 148
  - novæ-angliæ*, 111
  - opaca*, 320

- parvimaculata, 318  
 rufitibia, 303  
 surda, 296  
 suspecta, 304  
 tetrachæta, 130  
 tornensis, 320  
 torreyæ, 292  
 trigonifera, 320  
 velutina, 106  
 Stannodes  
   gibbocostata, 387  
 Staphylinus  
   cinnamopterus, 78  
 Stenolophus  
   dissimilis, 78  
 Stenus  
   punctatus, 78  
 Stigmatomma  
   pallipes, 2  
 Stilicis  
   latiusculus, 78  
 Stomoxys  
   calcitrans, 84, 86  
*Stylurodora*, 476  
   *stylata*, 476  
 Stroblia  
   triangula, 46  
 Strymon  
   acadica  
     souhegan, 387  
 Symmoca  
   novimundi, 386  
*Synorbitomyia*, 442  
  
*Tachinodexia*, 457  
 Tachinus  
   limbatus, 79  
 Tanæcium  
   crucigerum, 523  
 Tapinoma  
   littorale, 13  
   melanocephalum, 13  
   sessile, 13  
 Tenebrio  
   molitor, 168, 173, 175  
 Tetralonia  
   testacea, 521  
  
 Tetramerinx  
   brevicornis, 287  
   femorata, 33, 49  
 Tetramorium  
   guineese, 11  
   simillimum, 11  
*Thecocarcelia*, 471  
*Thelodiscoprosopa*, 444  
   *formosana*, 445  
*Thelycarcelia*, 475  
   *thrix*, 475  
 Themira  
   putris, 85  
 Theridion  
   troglodytes, 20  
 Thyce  
   *bidentata*, 201  
 Thyris  
   maculata, 387  
 Tibicen  
   bifidus, 244  
   cultriformis, 242  
   inauditus, 244  
   montezuma, 244  
   pruinosa, 242  
   robinsoniana, 242  
   tigrina, 244  
*Tipulidomima*, 458  
   *tessmanni*, 458  
 Trachymyrmex  
   septentrionalis, 12  
   seminola, 12  
 Trachysectus  
   confluentus, 78  
*Trichoberia*, 439  
   *rufopilosa*, 440  
 Tricoceps  
   brunnicornis, 217  
   curvispina, 217  
   pubipennis, 217  
 Trox  
   insularis, 79  
 Tshaka  
   naturalis, 226  
   obortus, 226  
   undulatus, 226



- Tyridiomyces*  
  *formicarum*, 11
- Umfilianus*  
  *declivis*, 208  
  *fenestratus*, 208
- Uroxiphus*  
  *maculiscutum*, 220  
  *simplex*, 220
- Voria*  
  *ruralis*, 84
- Wasmannia*  
  *auropunctata*, 11
- Wiedemanniomyia*, 469
- Xantholarvævora*, 465  
  *formosa*, 465
- Xanthopetia*, 452
- Xanthostieta*  
  *bulbacea*, 207  
  *typica*, 207
- Xenomymex*  
  *stolli*, 7
- Xiphistes*  
  *attenuata*, 231
- concolor*, 231  
  *crassicornis*, 231  
  *dilaticornis*, 231  
  *exigua*, 231  
  *furicornis*, 231  
  *lagænsis*, 231  
  *longicornis*, 230  
  *suberecta*, 231  
  *sulcicornis*, 230  
  *tanganensis*, 231  
  *tuberculatus*, 231  
  *vetusta*, 230
- Xiphistoides*  
  *carinata*, 229  
  *inermis*, 229
- Xiphopæus*  
  *erectus*, 222  
  *horridulus*, 222  
  *palmaris*, 222  
  *phantasma*, 222  
  *validicornis*, 222  
  *vomeris*, 222
- Zambesopsis*, 451
- Zosteromyia*  
  *braueri*, 457
- Zosteromyiopsis*, 456



# The New York Entomological Society

Organized June 29, 1892—Incorporated June 7, 1893

---

The meetings of the Society are held on the first and third Tuesday of each month (except June, July, August and September) at 8 P. M., in the AMERICAN MUSEUM OF NATURAL HISTORY, 77th Street and Columbus Avenue.

Annual dues for Active Members, \$3.00; including subscription to the Journal, \$4.50.

Members of the Society will please remit their annual dues, payable in January, to the treasurer.

---

## Officers for the Year 1932

*President*, ANDREW J. MUTCHLER.....American Museum of Natural History, N. Y.

*Vice-President*, ERNEST L. BELL.....150-17 Roosevelt Ave., Flushing, Long Island

*Secretary*, ELIZABETH SHERMAN.....132 Primrose Ave., Mt. Vernon, N. Y.

*Treasurer*, GAYLORD C. HALL.....144 E. 22nd St., New York

*Librarian*, FRANK E. WATSON.....American Museum of Natural History, New York

*Curator*, A. J. MUTCHLER.....American Museum of Natural History, New York

## EXECUTIVE COMMITTEE

WM. T. DAVIS

DR. WM. MOORE

HERBERT F. SCHWARZ,

HOWARD NOTMAN,

HENRY BIRD.

## PUBLICATION COMMITTEE

HARRY B. WEISS,

CHARLES W. LENG

JOHN D. SHERMAN, JR.,

C. E. OLSEN.

## PROGRAM COMMITTEE

C. H. CURRAN

HARRY B. WEISS,

J. L. HORSFALL

## AUDITING COMMITTEE

E. L. BELL,

DR. E. K. SCHWARZ,

DR. E. R. P. JANVRIN.

## FIELD COMMITTEE

A. S. NICOLAY,

MRS. A. S. NICOLAY

## DELEGATE TO THE N. Y. ACADEMY OF SCIENCES

WILLIAM T. DAVIS

# JOURNAL

of the

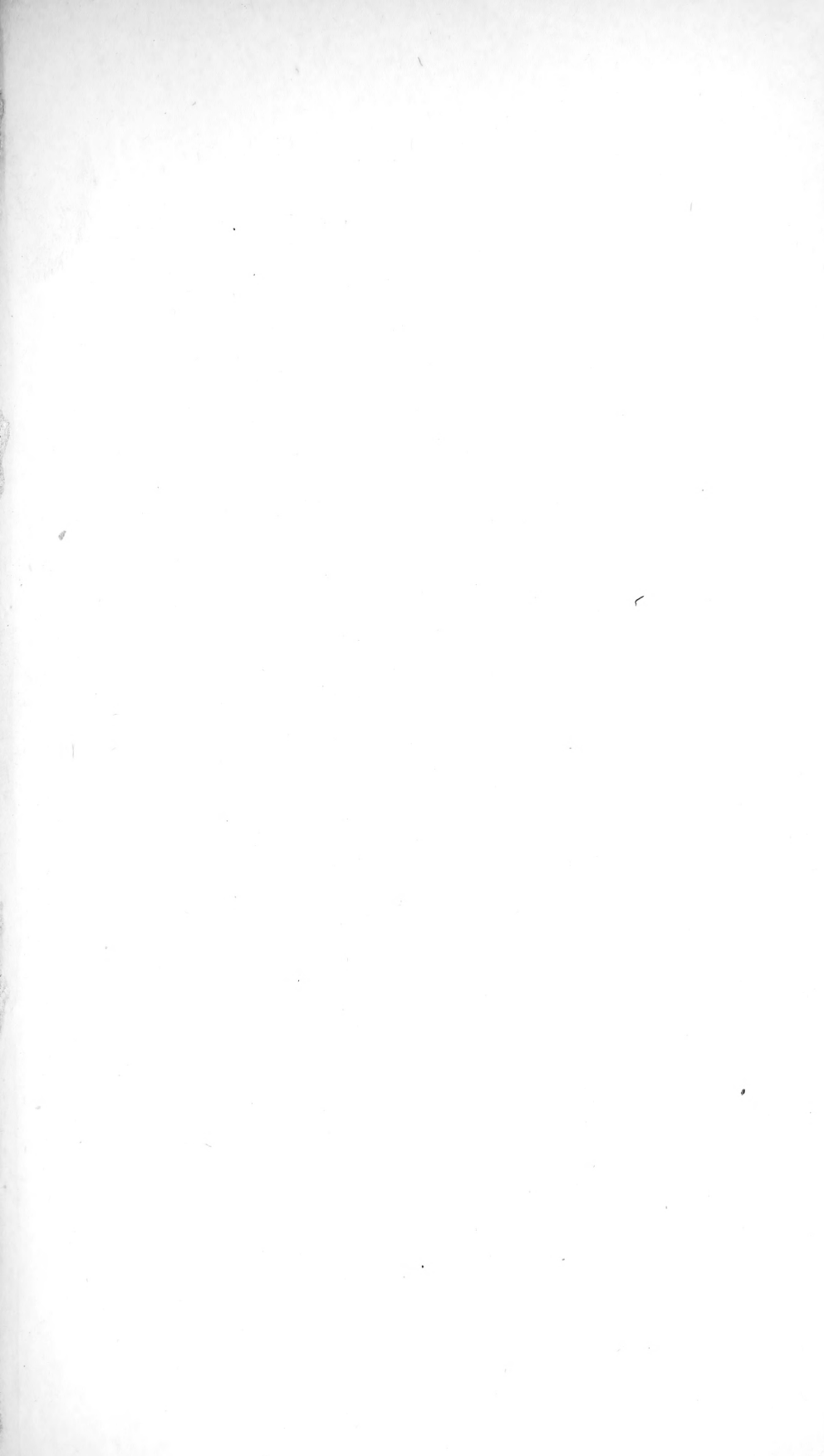
## NEW YORK ENTOMOLOGICAL SOCIETY

Published quarterly by the Society at Lime and Green Sts., Lancaster, Pa. All communications relating to the Journal should be sent to the Publication Committee, New York Entomological Society, American Museum of Natural History, New York City; all subscriptions to Lime and Green Sts., Lancaster, Pa., or to the Treasurer, Gaylord C. Hall, 144 E. 22nd St., New York City, and all books and pamphlets to the Librarian, Frank E. Watson, American Museum of Natural History, New York City. Terms for subscription, \$3.00 per year, strictly in advance. *Please make all checks, money-orders, or drafts payable to New York Entomological Society.*

Twenty-five reprints without covers are furnished free to authors. Additional copies may be purchased at the following rates:

|                                                     | 4 pp.                                        | 8 pp.  | 12 pp. | 16 pp. | 24 pp. | 32 pp. |
|-----------------------------------------------------|----------------------------------------------|--------|--------|--------|--------|--------|
| 25 copies .....                                     | \$2.40                                       | \$5.22 | \$5.58 | \$5.58 | \$9.00 | \$9.60 |
| Additional 100's .....                              | .60                                          | 1.44   | 1.92   | 1.92   | 3.00   | 3.00   |
| Covers .....                                        | 50 copies, \$2.50; additional 100's, \$1.50. |        |        |        |        |        |
| Half-tone prints 1½ cents for each half-tone print. |                                              |        |        |        |        |        |

Authors whose papers are illustrated with text figures or full page plates will be required to supply the electrotypes or pay the cost of making the same by the Journal and also to pay the cost of printing full page plates on coated paper, when advisable.

















SMITHSONIAN INSTITUTION LIBRARIES



3 9088 00833 6471